Operating Instructions

Compact Titrator

G10S/G20S

METTLER TOLEDO

Table of Contents

1 Introduction

Thank you for choosing a METTLER TOLEDO Compact Titrator. The Compact Titrator is an easy-to-operate instrument for titrations.

About this document

The instructions in this document refer to titrators running firmware version 5.2.0 or higher.

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▶ www.mt.com/contact

Conventions and symbols

Refers to an external document.

Note for useful information about the product.

Elements of instructions

- Prerequisites

1 Steps

2 …

   ⇨ Intermediate results

⇨ Results

2 Safety information

- Read and understand the information in these Operating Instructions before you use the instrument.
- Keep these Operating Instructions for future reference.
- Include these Operating Instructions if you pass on the instrument to other parties.

If the instrument is not used according to the information in these Operating Instructions or if it is modified, the safety of the instrument may be impaired and Mettler-Toledo GmbH assumes no liability.

2.1 Definition of signal words and warning symbols

Safety notes are marked with signal words and warning symbols. These show safety issues and warnings. Ignoring the safety notes may lead to personal injury, damage to the instrument, malfunctions and false results.

Signal words

WARNING	for a hazardous situation with medium risk, possibly resulting in death or severe injury if not avoided.
NOTICE	for a hazardous situation with low risk, resulting in damage to the instrument, other material damage, malfunctions and erroneous results, or loss of data.

Warning symbols

Electrical shock

2.2 Product-specific safety notes

Intended use

This instrument is designed to be used in laboratories by trained staff. The instrument is suitable for the processing of reagents and solvents.

Any other type of use and operation beyond the limits of technical specifications without written consent from Mettler-Toledo GmbH is considered as not intended.

Responsibilities of the instrument owner

The instrument owner is the person that uses the instrument for commercial use or places the instrument at the disposal of the staff. The instrument owner is responsible for product safety and the safety of staff, users and third parties.

METTLER TOLEDO assume that the instrument owner provides the necessary protective gear, appropriate training for the daily work and for dealing with potential hazards in their laboratory.

Safety notes

⚠ WARNING

Danger of death or serious injury due to electric shock!

Contact with parts that contain a live current can lead to injury and death.

1 Only use a METTLER TOLEDO power cable and AC adapter designed for your instrument.
2 Connect the power cable to a grounded power outlet.
3 Keep all electrical cables and connections away from liquids.
4 Replace damaged power cables and AC adapters immediately.

NOTICE

Danger of damaging the touch screen with pointed or sharp objects!

Pressing on the touch screen with pointed or sharp objects may damage it.

– Operate the touch screen by applying gentle pressure with the pad of your finger.

NOTICE

Danger of damage to the instrument due to incorrect parts!

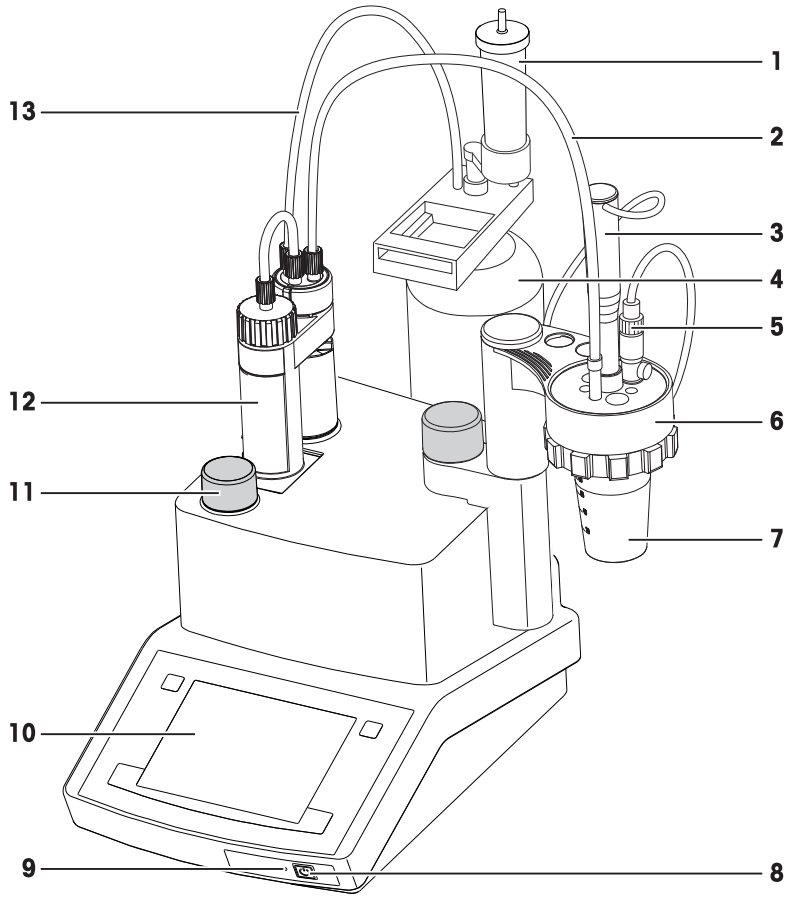
Using incorrect parts with the instrument can damage the Instrument or cause the instrument to malfunction.

– Only use parts supplied with the instrument, listed accessories and spare parts from METTLER TOLEDO.

3 Design and function

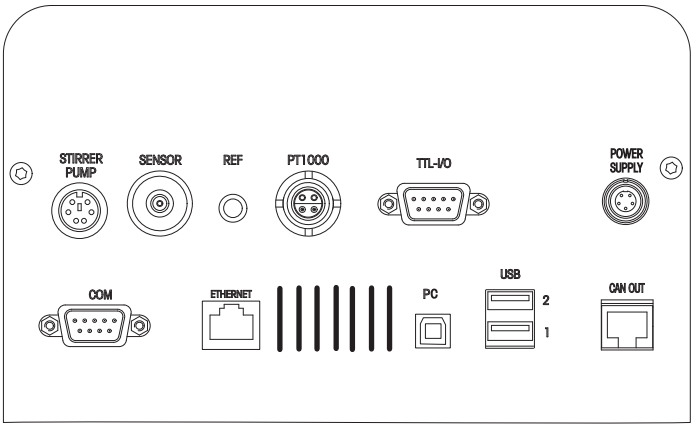
3.1 Instrument

3.1.1 Overview



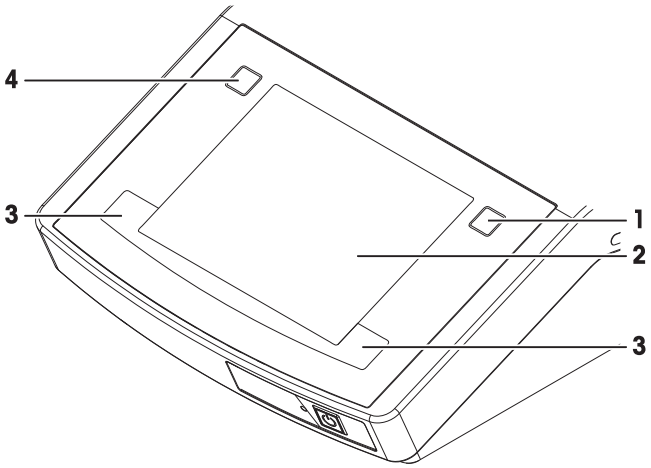
1	Titrant bottle drying tube	**8**	Power button
2	Dispensing tube	**9**	Indicator light (LED)
3	Compact stirrer	**10**	Touchscreen
4	Titrant bottle	**11**	Burette arrestment knob
5	Electrode	**12**	Burette
6	Titration stand	**13**	Suction tube
7	Titration vessel		

3.1.2 Titrator rear panel connections



Connection	Use	Example
STIRRER PUMP	Stirrer/pump	Solvent manager/compact stirrer/ pump
SENSOR	Measuring electrode	DGi115-SC
REF	Reference input to **SENSOR**	
PT1000	PT1000 temperature sensor	DT1000
TTL-I/O	Sample changer	Rondolino
POWER SUPPLY	AC adapter	AC adapter
COM	Balance	MS analysis balance
ETHERNET	Network	Link to LabX PC software via network
PC	PC connection via USB	Link to LabX PC software via USB interface
USB 1/USB 2	Printer/Memory stick/USB hub	USB-P25 compact printer
CAN OUT	CAN connection	For service use

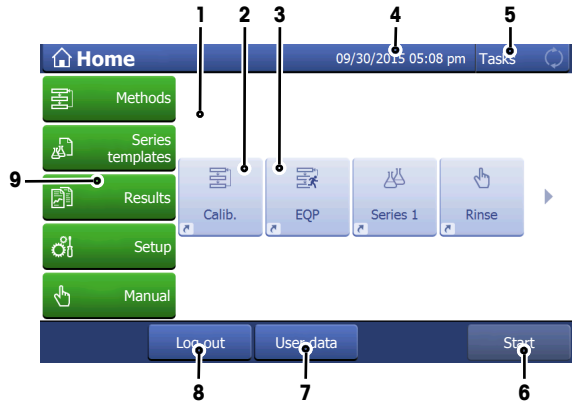
3.1.3 Terminal



Nr.	Name	Function
1	Info button	Accesses the interactive online help for the content of the current dialog.
2	Touch screen	Displays information and can be used to enter information.
3	Home button	Returns you to the home screen from any menu position.
4	**Reset** button	Ends all tasks that are currently running.

3.2 User interface

3.2.1 Home screen



	Name	Explanation
1	**Shortcut area**	Shows indirect and direct shortcuts for frequently used methods. Shortcuts are saved in the user profile and can be defined, changed and deleted by the user.
2	**Indirect shortcut**	An indirect shortcut opens the window **Start analysis** of the method.
3	**Direct shortcut**	A direct shortcut starts the method without opening the window **Start analysis**.
4	**Status bar**	The status bar contains the current menu item, user name as well as date and time.
5	**Instrument status**	Shows the current working status of the instrument. **Blue** No measurement running **Green** Measurement running
6	**Start**	Switch to direct measurement (quick start for the defined standard measurement of this instrument).
7	**User data**	Opens a window with information about the currently logged in user.
8	**Log out**	Directly log out the current user. The window **Login** opens after logging out.
9	**Menus**	**Methods** Create and handle methods for every measurement type.
		Series templates Open the menu for series templates for every method available on the instrument.
		Results Display all measurement results, print out or export them. Visit detail information about every single result.
		Setup Define all system settings in this menu, e.g,, hardware settings, user management or user preferences. These settings are usually made during installation of the instrument.
		Manual Display the manual operations available on the instrument.

3.2.2 Input field types

Various fields and lists allow you to enter or view data. Buttons on the right side show the type of the field or list.

Text input field

Any text comprised of letters (up tp 30 characters), numbers and symbols can be entered into these fields.

Text input field (extended)

Any text comprised of letters (up to 500 characters), numbers and symbols can be entered into these fields.

Number input field

Numbers, formulas and auxiliary values can be entered into these fields.

Drop-down list

A drop-down list opens from which you can select an entry.

Shortlist

A shortlist opens from which you can select an entry.

Formula field

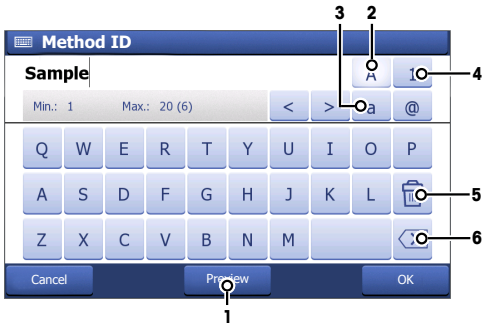
A formula must be entered in these fields.

Info field

The displayed content is only for information (read only).

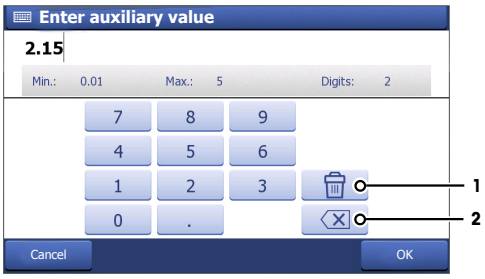
3.2.3 Keypads

Alphabetic keypad



- Tap (1) to see how your input looks like.
- Tap (2) for capital letters.
- Tap (3) for lowercase letters.
- Tap (4) to switch to a numeric keypad and (2) to turn back to alphanumeric.
- Tap (5) to delete all entered letters or numbers.
- Tap (6) to delete the last entered letter or number.

Numeric keypad



- Tap (1) to delete all entered numbers.
- Tap (2) to delete the last entered number.

3.2.4 Menu Structure

Methods

The menu **Methods** has no submenus.

Series templates

The menu **Series templates** has no submenus.

Results

The menu **Results** has the following submenus.

- **All results**
  Statistics
- **Samples**
- **Undo all**

Setup

The menu **Setup** has the following submenus.

Menu level 2	Menu level 3
Chemicals	**Titrants**
	Auxiliary reagents
	Calibration standards
	Titer standards
	Substances
User settings	**Language**
	Screen
	Audio signal
	Shortcuts
	Keyboard
Values	**Blanks**
	Auxiliary values
Hardware	**Sensors**
	Pumps
	Peripherals
	Titration Stands
	Auxiliary Instruments
Global settings	**System**
	User management
	Analysis and resources behavior
Mainten. & Service	**MT-Service**
	Import / Export
	Reset to factory settings
	Titrator firmware history
	Board firmware
	Terminal
	Board data
	Drives
	Burettes
	Update

Manual

The menu **Manual** has the following submenus.

- **Stirrer**
- **Sensor**
- **Burette**
- **Pump**
- **Auxiliary instrument**

3.2.5 Specific user dialogues

3.2.5.1 Start Analysis

An analysis - whether it be a single or multiple determination - can be started on the titrator in several different ways:

- By choosing **Start** from the method editor.
- By choosing **Start** from the Homescreen.
- By using a shortcut (or direct shortcut) from the Homescreen.
- By choosing **Start** from the screen **Series**.

- By choosing **Calibration** or **Titer** from the screen **Setup** dialog (in order to start a calibration or titer determination).

The screen **Start analysis** is always the first screen to appear once you choose **Start**, **Calibration**, **Sensor test** or **Titer** or the corresponding shortcut.

Note

- When a direct shortcut is activated, the screen **Start analysis** does not appear and the respective method starts immediately, provided that the other settings allow this.
- The parameters for the previously used method or series appear in the screen **Start analysis**, so that the same method can immediately be started again.
- Of course, all of the settings can also be adjusted prior to pressing **Start**. The type and number of settings displayed in the screen**Start analysis** depends on the type of analysis to be started and the resources used.

3.2.5.2 Online screen general titrations GT

The Online screen is displayed when an analysis or manual operation is being performed.

The method ID of the current method or the type of manual operation is displayed in the title bar. In the navigation bar below, the sample index, e.g. displayed as "Sample 2/5" (second of a total of five samples) and loop index, displayed as "Loop 1/3" (first of three loops) are shown. (The Loop index is only displayed if the method actually contains more than one loop). The navigation path is displayed in the navigation bar while a manual operation is being performed. The remainder of the online dialog is divided into a graphical area (left) and a data area (right). During a titration or measurement, the graphical area displays the measurement curve.

The Online dialog for a titration of type GT contains the following buttons:

Results

The **Results** button is used to display the results and statistics for the analyzed samples after the analysis.

Axes

You can select the units for the horizontal and vertical axes from a list.

Measured values

As an alternative to the online dialog, you can use the **Measured values** button to display a table of measured values during the analysis.

Samples

Choose **Samples** to change sample and series data.

Suspend

You can choose **Suspend** to displays the **Suspending options** dialog. You can save the series data or skip the sample or loop. In this dialog, you also have the option to continue the analysis or to stop it definitely

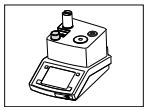
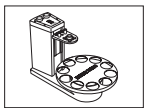
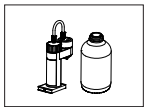
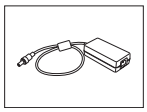
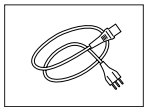
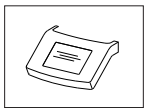
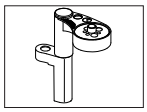
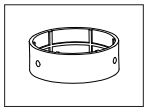
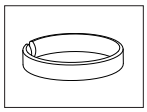
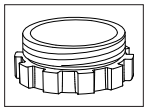
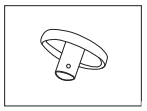
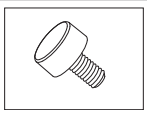
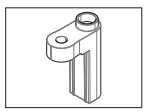
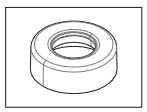
Note

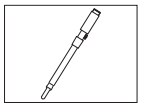
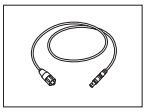
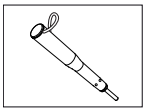
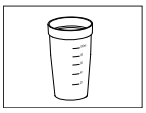
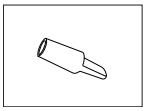
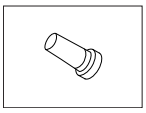
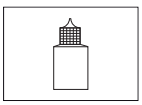
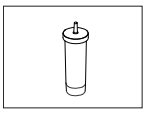
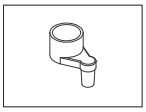
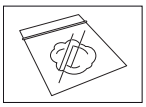
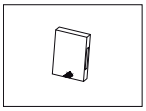
- Depending on the type of method function being performed, the online dialog displays various data such as measured values, remaining run times, volume dispensed, stirrer speed, duration of the analysis, or temperature.

4 Installation

4.1 Standard equipment

4.1.1 Scope of delivery

Part		Order number	G10S	G20S	G20S Rondolino
	Compact Titrator	–	•	•	•
	Sample changer Rondolino TTL	51108500	-	-	•
	Replacement burette (DV1020), complete 20 mL	51107502	•	•	•
	External power supply (100...240 V)	30298362	•	•	•
	Power cable (country-specific)	–	•	•	•
	Protective cover for touchscreen	51105567	•	•	•
	Titration stand without accessories	51109118	•	•	-
	Spacing ring	23842	•	•	-
	Clamping ring	25652	•	•	-
	Threaded ring	25652	•	•	-
	Cap (for titration stand)	51107608	•	•	-
	Clamping screw	51109084	•	•	•
	Electrode holder	51109059	-	-	•
	Reduction for electrode holder	51109052	-	-	•

Part		Order number	G10S	G20S	G20S Rondolino
	pH electrode, DGi115-SC	51109504	•	•	•
	Triaxial SC LEMO cable, 70 cm	89601	•	•	•
	Compact stirrer	51109150	•	•	•
	Titration vessel 100 mL, made from polypropylene (2 pcs.)	–	•	•	•
	NS 14.5 stopper (3 pcs.)	–	•	•	•
	NS 7.5 stopper (3 pcs.)	–	•	•	•
	3 mol/L KCl (25mL)	51343180	•	•	•
	Drying tube with cover	23961	•	•	•
	Drying tube holder	23915	•	•	•
	Glass wool (2 g)	51108143	•	•	•
	CD Titration User Documentation	30297239	•	•	•
	User Manual	–	•	•	•
	Memo Card	–	•	•	•
	Test report	–	•	•	•
	EC declaration of conformity	–	•	•	•

4.1.2 Unpack the titrator

1 Remove the titrator (and accessories) from the protective packing material.
2 Store the packing material for later transport over long distances.
3 Check if you received all parts listed in the scope of delivery.
4 Inspect the parts visually for flaws or damage.
5 If parts are missing or damaged, report it immediately and file a freight claim if needed.

4.1.3 Position the titrator

The instrument has been developed for indoor operation in a well-ventilated area. The following site requirements apply:

- The ambient conditions are within the limits specified in the technical data.
- No powerful vibrations
- No direct sunlight
- No corrosive gas atmosphere
- No explosive atmosphere
- No powerful electric or magnetic fields

4.1.4 Connect the titrator to the power supply

⚠ WARNING

Danger of death or serious injury due to electric shock!

Contact with parts that contain a live current can lead to injury and death.

1 Only use a METTLER TOLEDO power cable and AC adapter designed for your instrument.
2 Connect the power cable to a grounded power outlet.
3 Keep all electrical cables and connections away from liquids.
4 Replace damaged power cables and AC adapters immediately.

NOTICE

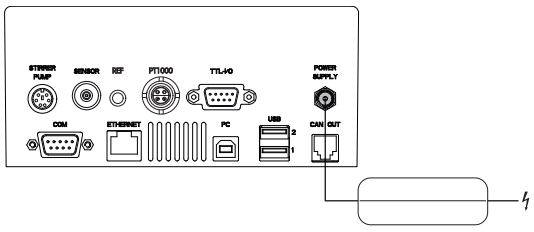
Danger of damage to the AC adapter due to overheating!

If the AC adapter is covered or in a container, it is not sufficiently cooled and overheats.

1 Do not cover the AC adapter.
2 Do not put the AC adapter in a container.

The titrator is operated using an AC adapter. The AC adapter is suitable for all supply line voltages ranging from 100...240 V AC ±10 % and 50-60 Hz.

1 Install the cables in such a way that they cannot be damaged or interfere with operation.
2 Insert the plug of the power cable in the socket of the AC adapter.
3 Insert the plug of the AC adapter in the **POWER SUPPLY** socket at the back of the titrator.
4 To secure the connection at the titrator, screw the plug connector firmly into place.
5 Insert the plug of the power cable in a grounded power outlet that is easily accessible.



4.1.5 Disconnect the titrator from the power supply

- The titrator has shut down.

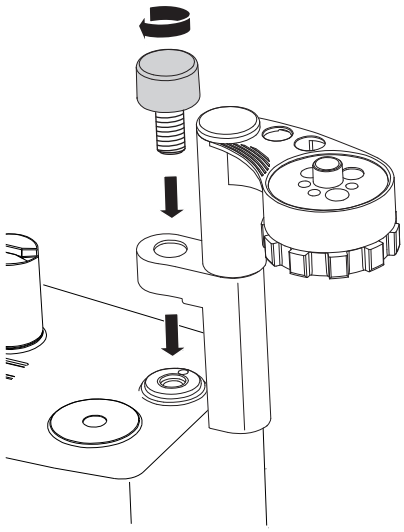
1 Pull the plug of the power cable out of the power outlet.
2 Pull the plug of the AC adapter out of the **POWER SUPPLY** socket at the back of the titrator.

4.1.6 Install the titration stand

4.1.6.1 Attach the titration stand to the titrator

- The spacing ring, clamping ring and threaded ring are mounted on the titration stand.

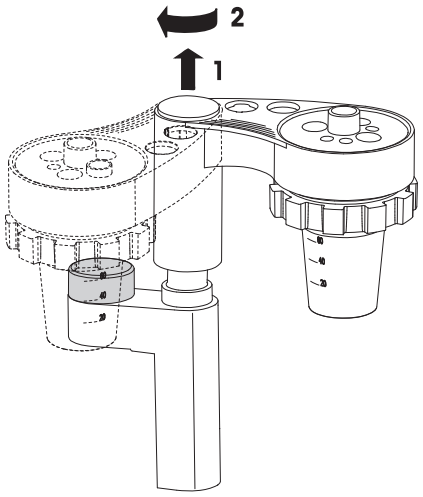
1 Remove the cover from the mounting hole.
2 Position the titration stand over the uncovered mounting hole.
3 Place the screw in the hole of the titration stand and screw it in the mounting hole.
4 Tighten the screw.



4.1.6.2 Swivel the titration stand

The titration stand can be swivelled among three predefined positions. If you use a compact stirrer, use the titration stand in the swivelled out position.

1 Pull the titration stand upward out of the holder until you feel resistance.
2 Swivel the titration stand to the desired position.
3 Slide the titration stand down until it rests on the holder.

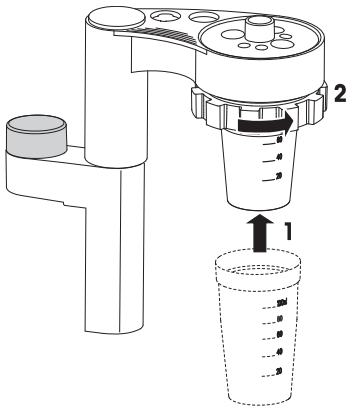


4.1.6.3 Attaching and removing the titration vessel

Attaching the titration vessel

- The titration stand is swivelled out.

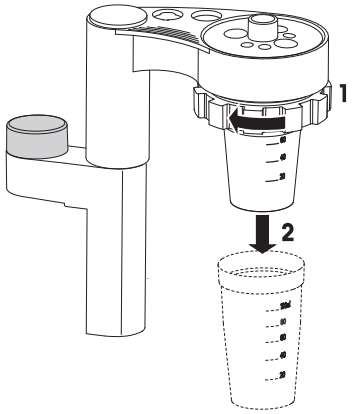
1 Turn the threaded ring a quarter to a half turn clockwise.
2 Guide the titration vessel upward (1) into the titration stand and hold the titration vessel in place.
3 Tighten the threaded ring (2).
4 Check that the titration vessel is firmly attached before you let it go.



Removing the titration vessel

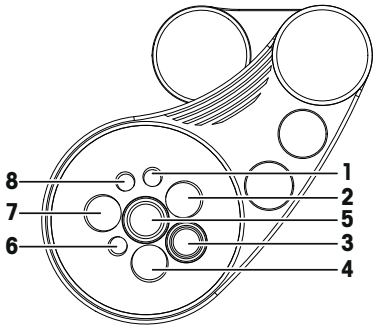
- The titration stand is swivelled out.

1 Hold the titration vessel with one hand.
2 Turn the threaded ring a quarter to a half turn clockwise (1).
3 Pull the titration vessel downward (2) out of the titration stand.



4.1.6.4 Recommended positions for sensors, tubes and stirrers

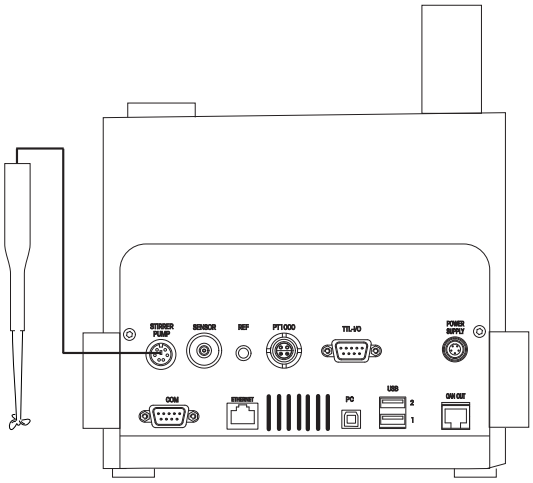
1 Dispensing tube
2 Sensor
3 Sensor or rinsing unit
4 Sensor
5 Compact stirrer
6 Dispensing tube
7 Sensor
8 Dispensing tube



4.1.7 Connect the compact stirrer

1 Insert the compact stirrer into the correct opening in the titration stand.
2 Shut down the titrator.
3 Plug the compact stirrer into the **STIRRER PUMP** socket on the rear of the titrator.
4 Start up the titrator.

⇨ The titrator detects the connected compact stirrer.



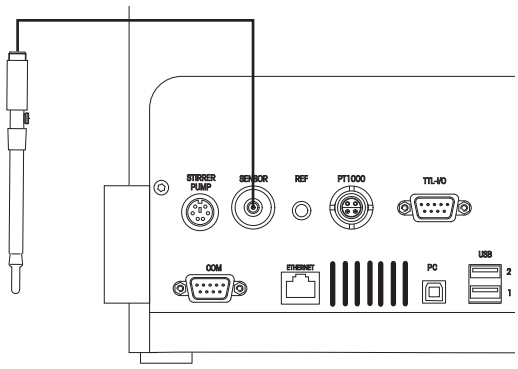
4.1.8 Connect the measuring electrode

- No task is running on the titrator

1 Insert the measuring electrode into an opening in the titration stand.

2 Connect the triaxial cable to the **SENSOR** socket on the rear of the titrator.

⇨ The titrator detects the measuring electrode.



4.1.9 Insert and connect a burette

Current generation burettes are equipped with an Smart Tag on the holder (visible by the small, black cover plate). The Smart Tag is used for reading and writing properties such as titrate name, concentration or usable life.

For a description of the burette, refer to the operating instructions supplied with burettes.

- The burette is assembled.
- The burette holder is mounted on the titrant bottle.
- The piston rod (5) is in the home position.

1 Turn the arrestment knob (6) in the opposite direction of the arrow.

2 Orient the burette so that the recesses on the driver arm (3) are parallel to the groove (7) on the base of the burette housing.

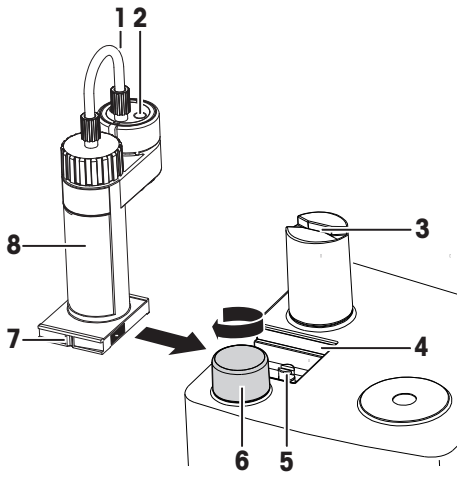
3 Slide the burette (8) on the guides (4) of the titrator.

4 Turn the arrestment knob (6) in the direction of the arrow to secure the burette.

5 Place the suction tube from the titrant botttle into the left hole (1) of the burette.

6 Place the dispensing tube into the right hole (2) of the burette.

7 To prevents spills, place the free end of the dispensing tube into the titration vessel, the waste bottle or another suitable container.



4.1.10 Connect a Rondolino TTL sample changer

The Rondolino sample changer is controlled by TTL signals from the titrator.

The installation of the sample changer is described in the separate Rondolino operating instructions.

- The sample changer is installed and switched off.

1 Shut down the titrator.

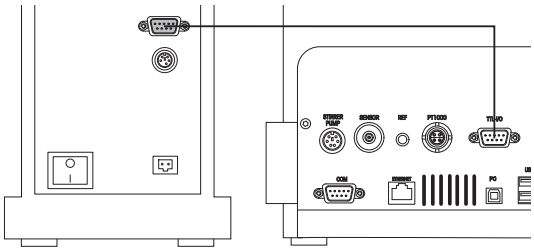
2 Plug the cable supplied with the sample changer into the **TTL-I/O** socket on the sample changer.

3 Plug the cable into the **TTL-I/O**socket on the rear panel of the titrator.

4 Start up the titrator.

5 Switch on the sample changer.

⇨ The titrator automatically detects the sample changer.



4.2 Optional equipment

4.2.1 Installing the solvent manager

1 Place the flat seal (7) on the opening of the bottle.

2 Screw the solvent manager (5) onto the bottle.

3 Loosen the threaded sleeve (3) on the solvent manager (5).

4 Push the thin end of the suction tube (1) through the threaded sleeve (3), so that it is just below the screw top.

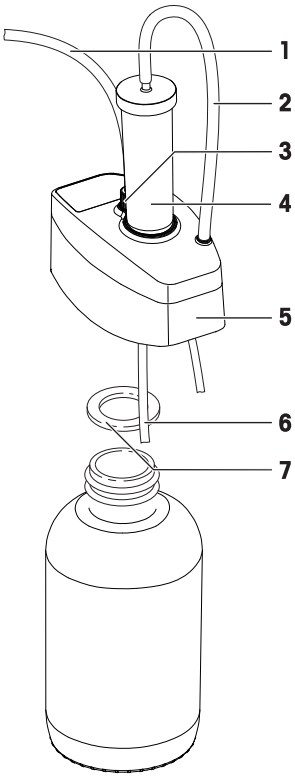
5 Tighten the threaded sleeve (3).

6 Fill a drying tube (4) with molecular sieve.

7 Press the drying tube (4) into the appropriate opening of the solvent manager.

8 With a silicone tube (167 mm) (2), connect the drying tube (4) of the bottle to the appropriate adapter of the solvent manager.

9 To ensure that the system has no leaks, check all tubes and closing points for firm seating.



4.2.2 Connecting the solvent manager

The installation of the solvent manager is described in the solvent manager kit installation manual. The following describes how to connect the solvent manager to the titrator on its own or in combination with the compact stirrer.

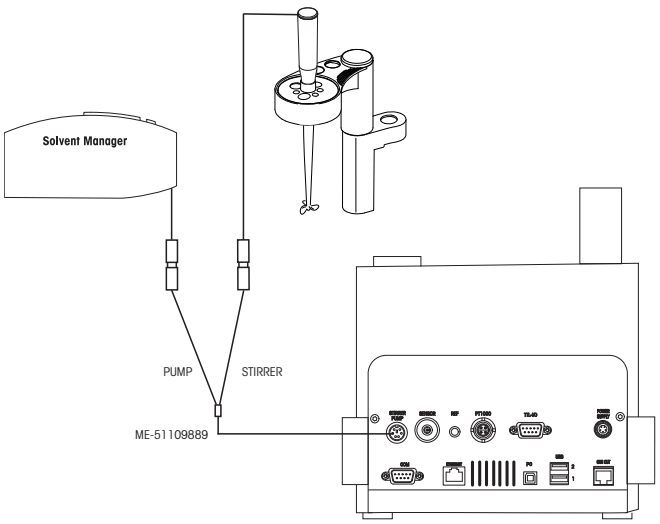
Connecting only the solvent manager

1 Turn the titrator off.

2 Plug the cable supplied with the solvent manager into the "STIRRER PUMP" socket on the rear of the titrator.

3 Turn the titrator on.

⇨ The titrator automatically detects the solvent manager.



Connecting the solvent manager and a compact stirrer

Note

- Correct functionality will only be provided if you use a Y cable "ME - 51109889" with **Index C** or higher (cable included in solvent manager kit).

1 Turn the titrator off.

2 Connect the Y cable to the "STIRRER / PUMP" socket on the rear of the titrator.

3 Connect the "PUMP" connection of the Y cable to the solvent manager.

4 Connect the "STIRRER" connection of the Y cable to the compact stirrer.

5 Turn the titrator on.

⇨ The titrator automatically detects the solvent manager and the compact stirrer.

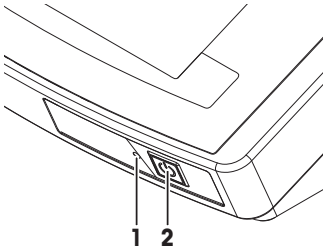
5 Operating the instrument

5.1 Start up the titrator and shut down the titrator

The power button is fitted with an LED and mounted on the front of the titrator. The LED indicates the operating status.

Start up the titrator

– Press the power button (2).
  ⇨ The titrator starts up and detects connected devices.
  ⇨ The LED (1) flashes as the system starts up.
  ⇨ The titrator is ready for use when the LED (1) remains permanently lit.



Shut down the titrator from the touch screen

– Tap **Home** > **Log out** > **Shut down**.
  ⇨ The titrator stops running tasks and shuts down.
  ⇨ The LED (1) flashes as the system shuts down, which can take up to 60 seconds.

⇨ When the LED goes out, the titrator has shut down. The built in AC adapter and the control circuit for the power button are energized. The rest of the titrator is no longer energized.

Shut down the instrument using the power button

– Press the power button for less than 1 second.
  ⇨ The titrator stops running tasks and shuts down.
  ⇨ The LED (1) flashes as the system shuts down, which can take up to 60 seconds.

⇨ When the LED goes out, the titrator has shut down. The built in AC adapter and the control circuit for the power button are energized. The rest of the titrator is no longer energized.

Shut down of the instrument in emergency situations

– Pull the plug of the power cable out of the power outlet.

5.2 Running a general titration

To explain the procedure for a titration method, a simple acid-base titration with a manual titration stand is described. 5 ml of HCl solution (0.1 mol/L) is titrated with NaOH (0.1 mol/L).

Material

Sensor: DGi115-SC

Chemicals

For this titration you need the chemicals listed below.

- Approx. 5 ml of a HCl solution (0.1 mol/L)
- A titrant bottle containing a carbonate free NaOH solution (0.1 mol/L)
- 3 buffer solutions: pH 4.01, 7.00 and 9.21 from METTLER TOLEDO
- Approximately 50 mg potassium hydrogen phthalate

5.2.1 Preparation

- The titrator is assembled, connected, and installed (see Installation).
- A compact stirrer is placed in the appropriate opening on the titration stand and connected to the **STIRRER PUMP** output of the titrator.
- A USB printer is connected to port **USB 1** or **USB 2** of the titrator.

1 Tap **Setup** > **Hardware** > **Titration Stands** > **Manual stand** > **Save**.
2 Prepare the 10 ml burette for the sodium hydroxide.
3 To protect the NaOH solution against CO_2, install a drying tube on the burette holder of the NaOH bottle.

4 Insert the burette.
   ⇨ An **Info** dialog appears, which allows you to initialize the burette. Burettes only have to be initialized the first time they are used on the titrator.
5 If you use the burette for the first time on the titrator, tap **Initialize**.
   ⇨ The titrator initializes the burette.
6 When the burette is initialized, remove the burette from the titrator and place the burette back on the titrator.
   ⇨ The titrator recognizes the initialized burette.
7 To create a new titrant for the burette, tap **Create**.
8 To assign a titrant to the burette, tap **Assign** .
   ⇨ The system updates the burette data and the assigned titrant appears with the suffix **PnP** in the setup.
9 Attach a titration vessel to the titration stand and connect the dispensing tube for the titrant to the titration head.

5.2.2 Rinsing and filling the burette

To fill the burette and tubes with titrant and remove any air bubbles from the system, rinse the burette three times with titrant with the manual operation **Rinse**.

- The titrator is prepared as described in [Preparation ▸ Page 22].

1 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
2 Make sure that the free end of the dispensing tube for the titrant is placed in the titration vessel or another container.
3 Tap **Manual** > **Burette** > **Rinse**.
   ⇨ The dialog **Rinse** opens.
4 Set **Titrant** to **NaOH 0.1 mol/L**.
5 Set **Cycles** to "3".
6 To start the rinse procedure, tap **Start**.
   ⇨ The rinse procedure starts and an animation shows the progress.
7 When the rinse procedure is complete, tap **OK**.
   ⇨ The dialog **Rinse** opens.

⇨ The burette is filled and the tubes are free of air bubbles.

5.2.3 Calibrating and testing the sensor

The following describes how to calibrate a pH sensor or carry out a sensor test.

Preparation

1 Make sure no analysis is running on the titrator.
2 Connect the plug of the sensor (DGi115-SC) to the port "SENSOR" of the titrator.
3 Insert the sensor into the titration head.
4 Prepare three titration vessels containing buffer solutions (pH 4.01, 7.00 and 9.21).

5.2.3.1 Calibrate the sensor

1 Tap **Methods** > **New** > **Standard method templates** > **Calibration**.
   ⇨ A list of method functions appears.
2 Tap **Sample (Calib)**.
   ⇨ The dialog **Sample (Calibration)** opens.
3 Make sure **Sensor** is set to DGi115-SC.
4 Make sure the settings for the buffer are as listed below.
   Buffer 1: 4.01
   Buffer 2: 7.00
   Buffer 3: 9.21

5 Tap **OK** > **Save**

⇨ The new method is saved in the method list, with the next free ID and with the title **Calibration**.

6 Tap **Start**.

⇨ The dialog **Start analysis** opens.

7 To ensure that the system has no leaks, check all tubes and closing points for firm seating.

8 Tap **Start**.

⇨ The system asks you to attach the titration vessel with sample 1 to the titration arm.

9 Attach the titration vessel with the buffer solution with pH 4.01 to the titration arm and tap **OK**.

⇨ The measurement starts after the stirring time.

⇨ During the measurement the online screen displays the time, the measured value in [mV] and a curve.

⇨ During the calibration, the system will output a record on the printer.

⇨ When the measurement is completed, the system asks you to attach the titration vessel with the next sample to the titration arm.

10 Remove the titration vessel from the titration arm.

11 Rinse the electrode with deionized water.

12 Repeat the last 3 steps for the buffer solution with pH 7.00 and the buffer solution with pH 9.21.

⇨ When the calibration is completed, the calibration data is automatically copied to the setup.

5.2.3.2 Test the pH-sensor

1 Tap **Methods** > **New** > **Standard method templates** > **Sensor test**.

⇨ A list of method functions appears.

2 Tap **Sample (Calib)**.

⇨ The dialog **Sample (Calibration)** opens.

3 Make sure **Sensor** is set to DGi115-SC.

4 Make sure the settings for the buffer are as listed below.
Buffer 1: 4.01
Buffer 2: 7.00
Buffer 3: 9.21

5 Tap **OK** > **Save**

⇨ The new method is saved in the method list with the next free ID and with the title **Sensor test**.

6 Tap **Start**.

⇨ The dialog **Start analysis** opens.

7 To ensure that the system has no leaks, check all tubes and closing points for firm seating.

8 Tap **Start**.

⇨ The system asks you to attach the titration vessel with sample 1 to the titration arm.

9 Attach the tiration vessel with the buffer solution with pH 4.01 to the titration arm and tap **OK**.

⇨ The measurement starts after the stirring time.

⇨ During the measurement the online screen displays the time, measurement in [mV] and the curve.

⇨ During the pH-sensor test, the system will output a record on the printer.

⇨ When the measurement is completed, the system asks you to attach the titration vessel with the next sample to the titration arm.

10 Remove the titration vessel from the titration arm.

11 Rinse the electrode with deionized water.

12 Repeat the last 3 steps for the buffer solution with pH 7.00 and the buffer solution with pH 9.21.

⇨ When the pH-sensor test is completed, the data is automatically copied to the setup.

5.2.4 Determining the titer

1 Weigh about 50 mg of potassium hydrogen phthalate and dissolve it in a titration vessel containing deionized water.

2 Tap **Methods** > **New** > **Standard method template** > **Titer with EQP**.
   ⇨ A list of method functions appears.
3 Tap **Sample (Titer)**.
4 Set the parameter **Entry** to **Before** and tap **OK**.
5 Tap **Titration (EQP)** > **Termination**.
6 Activate **After number of recognized EQPs**, set **Number of EQPs** to 1 and tap **OK**.
7 To exit the method function, tap **OK**
8 To save the new method, tap **Save**.
9 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
10 Tap **Start**.
   ⇨ The **Start analysis** dialog opens.
11 Enter the sample size.
12 Tap **Start**.
   ⇨ The titer determination begins.
   ⇨ The titrator asks you to add sample 1/1.
13 Attach the titration vessel with potassium hydrogen phthalate solution to the titration head and tap **OK**.
   ⇨ The titration starts after the stirring time.
   ⇨ During the titer determination, the online screen displays the measured pH values over the titrated volume in [mL].
   ⇨ After the titer determination is completed, the titer is copied to the setup.
14 After the titer determination is completed, rinse the sensor with deionized water.

5.2.5 Run an EQP titration

5.2.5.1 Prepare the sample

1 Fill 5 ml HCl (0.1 mol/L) into a titration vessel and dilute it with approx. 50 mL deionized water.
2 Attach the titration vessel to the titration arm.

5.2.5.2 Configure the method

1 Tap **Methods** > **New** > **Standard method template** > **EQP**.
2 Tap **Title**.
3 Enter a title for the new method in the field **Title** and tap **OK**.
4 Tap **Sample**.
5 In the parameter **ID 1** enter your choice of ID for the sample to be analyzed.
6 Set **Entry type** to **Volume**.
7 Set **Lower limit** to 6.0 mL.
8 Set **Upper limit** to 50.0 mL.
9 Set **Entry** to **Before** and tap **OK**.
10 Tap **Titration (EQP)** > **Termination**.
11 Activate the parameter **After number of recognized EQPs**, set **Number of EQPs** to 1 and tap **OK**.
12 To exit the method function, tap **OK**.
13 Tap **Calculation R1**.
14 Tap **Result proposals**.
15 Select the result **Content** with the unit **mol/L**.
   ⇨ The main parameters in the method function **Calculation R1** are filled in automatically.
16 Set **M [g/mol]** to **Hydrochloric acid** and tap **OK**.
17 Tap **Calculation R2**.
18 Tap **Delete**.
19 Tap **Save**.

5.2.5.3 Create an indirect shortcut

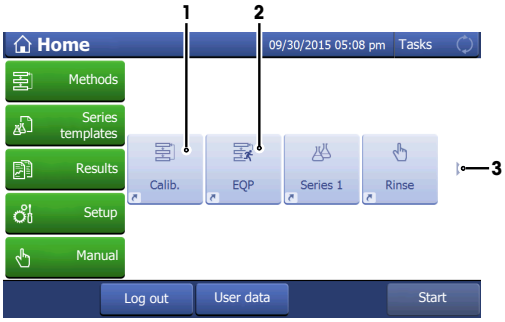
1 Tap **Start**.
⇨ The **Start analysis** window opens.
2 Tap **AddToHome**.
⇨ The **Shortcut parameters** window opens.
3 Enter a name for the shortcut in **Description**.
4 Make sure **Immediate start** is deactivated.
5 Tap **Save**.
⇨ The home screen with the new shortcut opens.

5.2.5.4 Perform the analysis

1 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
2 Select the shortcut on the home screen.
⇨ The dialog **Start analysis** opens.
3 In the parameter **Enter sample size** enter the sample size.
4 Tap **Start**.
⇨ You are prompted to add the sample.
5 If the titration vessel is not attached to the titration arm, attach the titration vessel containing the HCl solution to the titration arm and tap **OK**.
⇨ The titration starts after the pre-stirring period.
⇨ During the titration, the screen displays the measured pH values over the titrated volume in [mL].
⇨ After the titration, a record is printed.
⇨ All results are saved.
6 After the titration, rinse the sensor with deionized water.
7 To view the saved result, tap **Home** > **Results**.

5.3 Creating and handling Shortcuts

- Shortcuts (1, 2) can be created for methods, series templates and manual operations.
- With a shortcut (1) it is possible to access the dialog **Start analysis** with one tap on the homescreen.
- With a shortcut (2) it is possible to start a method, series or manual operation with one tap on the homescreen.
- The number of shortcuts depends on the type of titrator. If more than 12 shortcuts can be created, they can be placed on two screens. Tap (3) to switch between these two screens.
- Each user can manage the shortcuts that he has created in the instrument setup.



Types of shortcuts

Method

Sample Series

Manual operation

Creating a shortcut

1 Select **Methods** and choose your method category.
2 Create a new method or choose an existing method in the list.
3 Tap **Start**.
   ⇨ The **Start analysis** dialog opens. You can change some parameters or add some information to this method.
4 Tap **AddToHome** to create a shortcut.
5 Define the shortcut parameters.
6 Tap **Save**.

⇨ The shortcut is now set on the homescreen.

Deleting a shortcut

1 Select **Setup** > **User settings** > **Shortcuts**.
2 Select the shortcut which you want to delete in the list.
3 Tap **Delete**.

⇨ The shortcut is deleted.

Changing an existing shortcut

- At least one shortcuts has been created.

1 Tap **Setup** > **User settings** > **Shortcuts**.
   ⇨ A list of existing shortcuts opens.
2 Tap the shortcut you want to change.
3 If needed, change the settings for **Description** and **Immediate start**.
4 To change the position of the shortcut on the homescreen, tap .
   ⇨ A dialog opens that shows the free positions and the occupied positions on the homescreen.
5 Tap on the free position, where the shortcut should be placed.
   ⇨ The dialog closes.
6 To save the settings, tap **Save**.

Parameters	Description	Values
Type	Shows the type of action the shortcut stands for.	Method I Series I Manual operation
Description	Any name for the shortcut.	Arbitrary
Immediate start	The method, series, or manual operation can be started immediately. This enables you to start the analysis without any interfering dialog.	Activ I Inactive
Homescreen position	Defines the position of the shortcut on the homescreen.	-
Created by	Shows the name of the user who created the shortcut.	-

5.4 Creating Methods

You create a new method by changing the parameters of a delivered method template and saving it under a new method ID.

Navigation: **Home** > **Methods**

1 Tap **New** to create a new method on the basis of a template.
2 From the available templates, in **Mettler method templates** or **Standard method templates**, choose the one that is most similar to the method you wish to create.
   ⇨ You can now modify this method in line with your requirements by inserting or removing method functions or modifying its parameters.

3 In the method function **Title**, enter a new method ID. Afterwards, a new method will be stored under this method ID.

4 Assign a title to your new method.

5 Select available method functions to modify their parameters in line with your requirements.

6 Tap **Insert** to add additional method functions to the template.

7 Now use the arrow-shaped button to select the required position for the new method function in the method. (You will only be able to insert the method functions that are allowed in the corresponding location based on the method syntax.)

8 From the list, select the method function that you want to insert.

9 Modify the individual parameters of the method function in line with the resources.

⇨ The new method function appears in the method.

10 To delete a method function, select the function in question and then tap **Delete**.

⇨ The method function disappears from the method.

11 After inserting all required method functions, tap **Save**.

⇨ The method is saved under the method ID and appears in the list of available methods.

Note

- When establishing a new method, follow the rules specified by the instrument.

5.5 Modifying or Deleting Methods

You can change user methods or Mettler methods and store them under new method IDs.

Note

- Once a Mettler method has been modified, you will only be able to save it as a copy (or as a user method) with a new method ID.

Navigation: **Home** > **Methods**

1 From the displayed list of methods, select the method that you want to modify.

2 As soon as the methods functions of the selected method appear on the screen, you can modify the method.

3 In the method function **Title**, enter a new method ID. Afterwards, a new method will be stored under this method ID. You can enter up to twenty alphanumeric characters.

4 Select available method functions to modify their parameters in line with your requirements.

5 Choose **Insert** to add additional method functions to the template.

6 Now use the arrow-shaped **Insert** button to select the required position for the new method function in the method. (You will only be able to insert the method functions that are allowed in the corresponding location based on the method syntax.)

7 From the list, select the method function that you want to insert.

8 Modify the individual parameters of the method function.

⇨ The new method function appears in the method.

1 To delete a method function, select the function in question and then choose **Delete**.

2 After you have made all of the necessary adjustments, you can store the method in the titrator by choosing **Save**.

Deleting Methods

You can easily delete user-defined methods from the titrator. Select:

Navigation: **Home** > **Methods**

1 Select the method that you want to delete.

2 Choose **Delete method** to delete the method from the titrator's memory.

5.6 Starting Methods

The titrator offers various ways of starting a method:

- From the method editor
- By choosing **Start** from the Home dialog

- By using a shortcut on the Home screen
- Via the **Series** dialog
- By using the **Setup** dialog (to perform a calibration or titer determination)

You can use the method editor to start any method stored in the titrator.

1 From the displayed list in the **Methods** dialog, select the method that you wish to start (Home > Methods).

2 As soon as the method functions of the selected method appear on the screen, you can open the **Start analysis** screen by choosing **Start**.

3 Choose **Start** again to reach an overview screen on the resources required for the method. (Only if this was defined in the analysis sequence settings.)

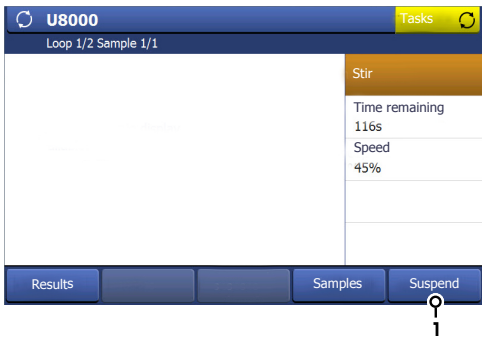
4 To execute the method, confirm the screen by choosing **OK**.

5.7 Stop methods

5.7.1 Suspending or stopping an analysis

1 Tap **Suspend** (1) to suspend the current analysis.

⇨ The dialog **Suspending options** opens.



2 Tap **Save series data** (1) to save the current sample series. Only the completed samples will be saved.

⇨ If the maximum permitted number of series has been reached, the series is not saved.

⇨ Sample data from a method that is waiting in a queue can be saved by selecting **Suspend** > **Save series data**.

3 Tap **Skip sample** (2) to skip the current sample and continue with the next sample of the series.

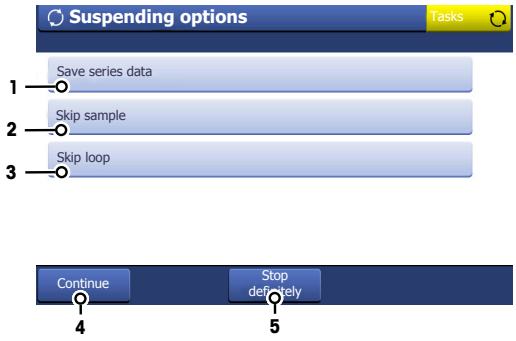
⇨ The current sample is marked in **Results** as **Excl.**.

4 Tap **Skip loop** (3) to skip the loop and continue with the next loop of the series.

⇨ The loop is marked in **Results** as **Excl.**.

5 Tap **Continue** (4) to continue with the current sample.

6 Tap **Stop definitely** (5) to stop the current method.



Note

- If a **Calib.** loop is skipped, the analysis continues in accordance with the corresponding method function **Calibration**.
- If required, it is possible to include a skipped sample (**Excl.**) into a statistic manually in the dialog **Results**.

5.7.2 Suspending of ongoing analysis by the titrator

The titrator can interrupt an analysis that is in progress for the following reasons:

- Exceeding the specified termination parameter "Termination" for the methods "titration (EQP) and titration (EP)".
- Due to end or equivalent points not being found during learn titrations.

  If no end or equivalent points are found during a learn titration an error message appears and the analysis is interrupted. You have the option of either canceling the titration or continuing after filling a new burette.

5.8 Customizing touch screen and signals

Navigation: **Setup** > **User settings**

5.8.1 Changing the language

In the menu **Language** you can set the language of the touch screen and the language for printing.

1 Tap **Setup** > **User settings** > **Language**.
2 Customize the settings.
3 To save the settings, tap **Save**.

Parameters	Description	Values
Touchscreen	Defines the language for operation of the terminal.	German I English I French I Italian I Spanish I Portuguese I Chinese I Russian I Polish I Korean
Record	Defines the language in which the reports are to be printed out.	German I English I French I Italian I Spanish I Portuguese I Chinese I Russian I Polish I Korean

5.8.2 Changing the screen settings

In the menu **Screen** you can customize following features.

- The color of the status bar, the borders and the buttons.
- The brightness of the touch screen.
- Activate or deactivate the screen saver and set the time before the screen saver is activated.

1 Tap **Setup** > **User settings** > **Screen**.
2 Customize the settings.
3 To save the settings, type **Save**.

Parameters	Description	Values
Primary color	Here various color schemes for the user interface can be selected.	Gray I Blue I Green I Red
Brightness	Specifies the display brightness in [%].	50 I 60 I 70 I 80 I 90 I 100 [%]
Screen saver	Here you can define whether the screen saver should be used.	Activ I Inactive
Wait time	Defines how long in [min] the system should wait after the user's last action on the terminal before activating the screen saver.	1…1000

5.8.3 Configuring the audio-signals

In the menu **Audio signal** you can define if a tap on a button is confirmed by a beep.

1 Tap **Setup** > **User settings** > **Audio signal** .
2 Customize the settings.

3 To save the settings, type **Save**.

Parameters	Description	Values
At push of a button	Enables a beep when tapping on the touch screen.	Activ I Inactive

5.8.4 Configuring the keyboards

In the menu **Keyboards** you can set the layout of the alphanumeric and the numeric keyboards.

1 Tap **Setup** > **User settings** > **Keyboards**.

2 Customize the settings.

3 To save the settings, type **Save**.

Parameters	Description	Values
ABC keyboard	Determines the layout of the alphanumeric input field.	English I French I German
123 keyboard	Defines the organization of the keys for the numeric input field.	Calculator I Phone

6 Methods

To carry out an analysis with the titrator, you require a **method**. A method is an analysis program and consists of a sequence of method functions (some with method subfunctions), which are processed by the titrator in sequence.

In this chapter, you will learn how to access and define methods.

The basic building blocks of a titration method consist of sample preparation, stirring and wait times, the actual titration, result calculation and a record. The titrator defines these partial steps as functions that consist of parameters whose values can be changed.

Loops

Within a method you can define one loop, which can run the series analysis n-times. (see Method Syntax - Rules for Creating a Method").

The beginning and end of a sample loop are defined by the method functions "Sample" and "End of Sample". The "End of Sample" method function is executed, and the sample loop stopped, only after the last sample in a series.

There are the following loop types:

- A **sample loop** is for analyzing a sample.
- A **calibration loop** is for calibrating a sensor.
- A **titer loop** is for determining the titer of a titrant.

Types of Methods

The titrator distinguishes between the following method types with different objectives:

- **GT**
  GTMethod for general titration (contains only sample loops or mixed loops)
- **Calibration**
  method for sensor calibration (contains only calibration loops).
- **Titer**
  Method for titer determination, contains only titer loops

Predefined methods

- **Mettler method templates**
  A number of methods have already been stored in the instrument. These methods were developed by METTLER TOLEDO for specific uses and can be used for the corresponding analysis.
- **Standard method templates**
  When creating methods you can revert to method templates, which specify the structure of the method, and whose parameters already contain the most suitable default values.

Method ID

You can distinguish between different types of method and individual methods of the same type using their ID:

- Each method has its own unique method identification.
- The method ID of the Mettler methods is composed of the starting letter "M" followed by a sequential number (M001, M002, ...). However, the method ID can be freely chosen when you save a method.

6.1 Method templates

6.1.1 Standard method templates

When you create a new method, the method templates prescribe the sequence of the method functions. These method templates are not application-specific, but are dependent on the type of titrator. They allow the user to establish user methods quickly and easily. Most of the settings in the method functions that occur in a standard method already have default values.

To convert a method template into a user method, it has to be saved under a method ID.

Title	Description	Method type
EQP	Equivalence point titration	General titration
EP	End point titration	General titration

Measure	Is used for the controlled transfer of a sensor measuring value.	General titration
Lern-EQP	Is used to determine the best parameters for carrying out an EQP titration.	General titration
Titer with EQP	Titer determination by EQP titration	Titer determination
Titer with EP	Titer determination by EP titration	Titer determination
Calibration	Sensor calibration (linear regression for all measurement points)	Calibration
Segmented calibration	Sensor calibration, taking into account non-linear sensor behavior	Calibration
Blank with EQP	Blank value determination of a solvent using the equivalence point titration	General titration
Blank with EP	Blank value determination of a solvent using the end point titration	General titration
pH Sensor test	To check the slope, zero point and drift of pH-sensors.	Calibration

6.1.2 Mettler method templates

A number of methods have already been stored in the instrument. These methods were developed by METTLER TOLEDO for specific uses and can be used for the corresponding analysis. These methods not only provide the sequence of the method functions, but they also define all of the method function settings. You create a new method by changing the parameters of a delivered method template and saving it under a new method ID.

The assortment of available methods depends on the device type.

Title	Description	Titrant	Sensor	ID
Acetic acid in vinegar	EQP-Titration	NaOH	DG115	M400
Free fatty acid content	EQP-Titration	KOH in Ethanol	DG113	M402
Blank solvent FFA	EQP-Titration	KOH in Ethanol	DG113	M403
Chloride content in Ketchup	EQP-Titration	$AgNO_3$	DM141	M404
Total hardness of tap water	EQP-Titration	EDTA	DP5	M405
Ca + Mg content of tap water	EQP-Titration	EDTA	Ca ISE	M406
Copper content	EQP-Titration	$Na_2S_2O_3$	DM140	M409
Hydrogen peroxide content	EQP-Titration	$KMnO_4$	DM140	M410
Vitamin C content voltametric	EQP-Titration	DPI	DM143	M411
m-Value of tap water (EP)	EP-Titration	HCl	DG115	M415
Free SO_2 content in wine	EP-Titration	J_2	DM143	M419
Bromine number ASTM D1159	EP-Titration	Bromide-Bromate	DM143	M424
Blank ASTM D1159	EP-Titration	Bromide-Bromate	DM143	M425
Acid number ASTM D664	EQP-Titration	KOH in 2 Propanol	DG113	M426
Blank ASTM D664	EQP-Titration	KOH in 2 Propanol	DG113	M427
Base number ASTM D4739	EQP-Titration	HCl in 2 Propanol	DG113	M428
Blank ASTM D4739	EQP-Titration	HCl in 2 Propanol	DG113	M429
Titer 0.1 mol/L NaOH	EQP-Titration	0.1M NaOH	DG115	M435
Calibration DG115-SC	Messung	pH Buffer: 4.01, 7.00, 9.21	DG115-SC	M436
FOS/TAC determination	EQP-Titration	1/2 H_2SO_4, 0.1 mol/L	DG115-SC	M664

6.2 Method syntax – rules for establishing a method

A method consists of a sequence of method functions that are executed consecutively when a method is processed.

Method functions can be located within a loop or outside of a loop. Method functions within a loop are performed for each sample if the loop contains more than one sample. Method functions outside of a loop are only performed once.

As an example, the list below shows the method functions for the standard method template **Measure (normal)**.

- **Title**
- **Sample**
- **Titration stand (Manual stand)**
- **Stir**
- **Measure (normal)**
- **Calculation R1**
- **End of sample**
- **Record**

The method function **Sample** marks the beginning of the loop and the method function **End of sample** marks the end of the loop. This means, that if this loop contains two samples, the method functions **Sample**, **Titration stand (Manual stand)**, **Stir**, **Measure (normal)** and **Calculation R1** are performed for each sample. The method function **End of sample** is performed, after the second sample is analysed. The loop is stopped and the method function **Record** is performed.

The number of loops and method functions allowed in a method differs depending on the method type and titrator type. When establishing a method, certain rules (method syntax) must be followed. These fundamental rules are described below.

6.2.1 Types and possible numbers of loops

The following table shows the maximum number of loops, the maximum numbers of method functions and the allowed loop types for the different types of titrators and method types.

Method type	Permissible loop types	Maximum number of loops per method	Maximum number of method functions per method	
			G10S	G20S
General titration	Sample loop Titer loop Calibration loop	1	10	12
Titer	Titer loop	1	10	12
Calibration	Calibration loop	1	10	12

6.2.2 Possible numbers of method functions

The following table shows the maximum number of method functions that can be used within a method.

Method function	Max. number method functions
Title	1
Sample	1
Sample (Titer)	1
Sample (Calibration)	1
Titration stand	1
Pump	1
Stir	2
Dispense (normal)	1
Measure (normal)	1
Titration (EP)	2
Titration (EQP)	2
Titration (Learn EQP)	2
Calculation	3

Method function	Max. number method functions
End of sample	1
Titer	1
Calibration	1
Auxiliary value	1
Blank	1
Auxiliary instrument	2
Drain	1
Record	2

6.2.3 Method functions within a loop

The method functions that are permitted within a loop are limited and depend on the loop type. Follow the rules listed below when you place a method function within a loop.

- One method function **Titration stand** must appear immediately after the loop-initializing functions **Sample**, **Sample (Calib)** or **Sample (Titer)**. Additional method functions **Titration stand** can be used in other position within the loop.
- The method function **Record** must be inserted after the method function that generates the results the record should contain.
- The method function **Calculation** must be inserted after the method function that determines the raw results for the calculation.
- A calibration loop must contain exactly one method function **Measure (normal)**.
- A titer loop must contain at least one method function titration.

The table below shows the method functions allowed within a loop.

Method function	General titration, Titer	Calibration
Titration stand	•	•
Pump	•	•
Stir	•	•
Dispense (normal)	•	•
Measure (normal)	•	•
Titration (EP)	•	–
Titration (EQP)	•	–
Titration (Learn EQP)	•	–
Calculation	•	•
Auxiliary value	•	•
Blank	•	•
Auxiliary instrument	•	•
Drain	•	•
Record	•	•

6.2.4 Method functions outside of a loop

In addition to the preset method function **Title**, which always appears at the start, additional method functions can be inserted outside of a loop depending on the method type. Follow the rules listed below when you place a method function outside of a loop.

- The method function **Calibration** must appear immediately after the method function **End of sample** of a calibration loop.
- The method function **Titer** must appear immediately after the method function **End of sample** of a titer loop.

Method function	General titration, Calibration, Titer
Drain	•

Method function	General titration, Calibration, Titer
Calculation	•
Blank	•
Dispense (normal)	•
Auxiliary instrument	•
Auxiliary value	•
Calibration (position is fixed)	•
Pump	•
Record	•
Titer (position is fixed)	•

6.3 Overview of Method functions

Method function	Explanation	Inside loop	Outside loop
Title	Title and characteristics of the method.	No	Yes
Sample	Start of a sample loop.	Start of loop	
Sample (Titer)	Start of a loop for titer determination	Start of loop	
Sample (Calibration)	Start of a loop for sensor calibration.	Start of loop	
Titration stand	Selects titration stand.	Yes	No
Pump	Pumps a defined volume of a liquid.	Yes	Yes
Stir	Activates a stirrer.	Yes	No
Dispense (normal)	Dispenses a defined quantity of titrant.	Yes	Yes
Measure (normal)	For the controlled acquisition of a measured value from a sensor.	Yes	No
Titration (EQP)	Conducts an equivalence-point titration.	Yes	No
Titration (Learn EQP)	Conducts an equivalence-point titration to determine optimal settings for the parameters of an equivalence-point titration. Once the equivalence point is found, the **Titration (Learn EQP)** is transformed into a **Titration (EQP)** with the optimal parameters. If the analysis has more than one sample, the subsequent samples are titrated and analyzed with these optimal parameters.	Yes	No
Titration (EP)	Conducts an end-point titration.	Yes	No
Calculation	Converts the analysis results.	Yes	Yes
End of sample	Concludes a sample loop.	End of loop	
Titer	Assigns the result of a titer sample loop to a titer.	No	Yes
Calibration	Assigns the result of a calibration loop to a sensor.	No	Yes
Auxiliary value	Assigns a result or an arbitrary value to an auxiliary value and updates the value stored in **Setup**.	Yes	Yes
Blank	Assigns a result or an arbitrary value to a blank and updates the value stored in **Setup**.	Yes	Yes
Auxiliary instrument	Activates external auxiliary instruments.	Yes	Yes
Drain	Drains a volume from the sample vessel.	Yes	Yes
Record	Defines the record data to be output to the printer.	Yes	Yes

6.4 Description of method functions

6.4.1 Title

Defines the title and type of a method and manages properties such as the creation and change date, the author, and whether or not the method is to be protected.

Parameters	Description	Values
Type	Shows the method type.	Compatible method types
Compatible with	Shows the titrator types for which this method can be loaded and executed.	Compatible titrator types
ID	Unique ID of the method.	Arbitrary
Title	Title of the method.	Arbitrary
Author	Shows the author of the method.	-
Created on	Shows creation date and creation time of the method.	–
Modified on	Shows date and time of the last change to the method.	-
Modified by	Shows the name of the user who made the last change.	–
Protect	Protects the method against changes and deletion by any user other than the author or the administrator.	Activ I Inactive
SOP	Standard operating procedure.	Activ I Inactive
SOP-Text	Text for a standard operating procedure Only if **SOP** = **Text** is selected.	Arbitrary
SOP-ID	ID for the link to a standard operating procedure. Only if **SOP** = **Link** is selected.)	Arbitrary

6.4.2 Sample

The **Sample** and **End of sample** method functions define the beginning and the end of a sample loop. All of the method functions contained in a loop are conducted for each sample in a series. The method functions are conducted in accordance with **End of sample** only after processing the last sample.

Parameters	Description	Values
Number of IDs	Defines the number of sample IDs to be defined.	1…3
ID 1	The ID for the first or only sample of an analysis.	Arbitrary
ID 2…ID 3	The name defined here will be used as the default name for the respective sample on the sample loop. Only appears subject to the settings made for **Number of IDs**.	Arbitrary
Entry type	Defines whether the sample should be added with a defined mass, defined volume or defined number of pieces. The sample data query will then adjust according to the unit of measurement. **Fixed volume** or **Fixed pieces**: The sampling weight, sample volume or number of pieces will be entered as the parameter in this method function and will not be prompted when conducting the method.	Weight I Fixed weight I Volume I Fixed volume I Pieces I Fixed pieces
Lower limit	Defines the lower limit for the variable entry data. The unit will depend on the setting for **Entry type** parameter. Only appears if none fixed values are selected in **Entry type**.	[g]: 0 … 1000 [mL]: 0 … 1000 [pcs.]: 0 … 10^6
Upper limit	Defines the upper limit for the variable entry of data. The unit will depend on the setting for **Entry type** parameter. Only appears if none fixed values are selected in **Entry type**.	[g]: 0 … 1000 [mL]: 0 … 1000 [St.]: 0 … 10^6
Weight	Weight in [g]. Appears only if **Entry type** = **Fixed weight** was selected.	0…1000
Volume	Volume in [mL]. Appears only if **Entry type** = **Fixed volume** was selected.	0…1000

Pieces	The number of sample(s). Appears only if **Entry type** = **Fixed pieces** was selected.	0…10^6
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000
Density	The density of a liquid sample substance, in [g/mL]. Appears only if **Entry type** is set to **Weight**, **Volume**, **Fixed weight** or **Fixed volume**.	0.0001…100
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200
Entry	Determines the entry time for the sample size. **Before**: The sample size must be entered before the titration. **Arbitrary**: The sample size will have to be entered at any time during the titration (no later than when it is used during the calculations). Only appears if none fixed values are selected in **Entry type**.	Before I Arbitrary

6.4.3 Sample (titer)

Start of a loop for titer determination Contains all of the necessary data regarding the titrant and the standard to be used.

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-
Standard	Select the name of the standard from the standards list.	Select from the standards defined in the setup.
Type of standard	Shows the type of standard.	solid I liquid
Entry type	Defines whether the quantity (weight or volume) of a liquid or solid standard should be entered when the analysis is started or whether a **Fixed weight** or a **Fixed volume** should be defined in the method function. The available options depend on the setting of **Type of standard**.	Weight I Fixed weight I Volume I Fixed volume I Pieces I Fixed pieces
Lower limit	Defines the lower limit for the variable entry of sample data in [mL] or [g]. The unit will depend on the setting for **Entry type** parameter. Applies only for **Entry type** = **Weight** and **Volume**.	0...1000
Upper limit	Defines the upper limit for the variable entry of data. The unit will depend on the setting for **Entry type** parameter. Only appears if none fixed values are selected in **Entry type**.	[g]: 0 … 1000 [mL]: 0 … 1000 [St.]: 0 … 10^6
Weight	Weight in [g]. Appears only if **Entry type** = **Fixed weight** was selected.	0…1000
Volume	Volume in [mL]. Appears only if **Entry type** = **Fixed volume** was selected.	0…1000
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

Entry	Determines the entry time for the sample size. **Before**: The sample size must be entered before the titration. **Arbitrary**: The sample size will have to be entered at any time during the titration (no later than when it is used during the calculations). Only appears if none fixed values are selected in **Entry type**.	Before I Arbitrary

6.4.4 Sample (calibration)

Start of a loop for sensor calibration. Contains all of the necessary data regarding the sensor and the calibration standard.

Parameters	Description	Values
Sensor type	Specifies the type of sensor that is calibrated	pH I ISE I Temperature
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Action	Defines if a calibration or a sensor test is performed.	Calibration I Sensor test
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I pH I ppm I pM I pX I %T I A I µA I °C I K I °F
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary
Automatic buffer recognition	Defines whether the titrator should automatically identify the buffers via the pH buffer list. Only possible for pH sensors.	Activ I Inactive
pH buffer list	Defines the pH buffer list to be used for the calibration of a pH sensor.	Select from the pH buffer lists (Auto pH buffer lists) defined in Setup.
List of standards	Defines the standards list to be used for the calibration of an ISE or conductivity sensor.	Select from the standards lists defined in Setup.
Calibration	Here you can define whether the calibration of a pH or ISE sensor should be done in a linear or segmented manner.	Linear I Segmented
Number of buffers	The number of buffers to be used for the calibration of a pH sensor.	1…9
Number of standards	The number of standards to be used for the calibration of an ISE sensor.	1…9
Buffer 1…9	Defines the buffers used for the calibration or sensor test of a pH sensor. For the calibration, up to nine buffers can be selected from the pH buffer list. For the sensor test, two buffers must be selected from the pH buffer list.	List of available pH buffers
Standards 1…9	For the calibration of an ISE sensor, up to nine standards can be selected from the standards list.	Select from the standards list.
Standard	Select the name of the standard from the standards list.	Select from the standards defined in the setup.
Temperature	The temperature during the calibration in [°C] if temperature acquisition has not been selected in the method function **Measure (normal)**. Does not appear for temperature sensors.	-20°C…200°C

6.4.4.1 pH sensor test

The sensor test is used to check the slope, zero point and drift of pH sensors.

The test can be started either by using a method or sample series via the "Calibration" method function or directly from the Setup of the sensor concerned (see also "[Setup: Hardware > Sensors > Sensor Calibration and Sensor Test ▸ Page 85]").

Note

- The calibration data of the pH sensor is not affected by the test.
- The results of the sensor test can be printed out.

Starting the sensor test via a method

Start the sensor test as follows:

1 Select a method of the "Calibration" type or create the appropriate method.

2 Select the "Sample (Calibration)" method function.

3 In the **Sample (Calibration)** dialog window, select the following parameters:
- "Sensor type" = "pH"
- "Action" = "Sensor test"

4 Specify the buffer parameters to be used (See "Methods: Method functions > Sample (Calibration)". The sensor test is carried out using two buffer solutions.

5 Press **OK**.

6 Select the "Calibration" method function

7 Define the following parameters in the **Calibration** dialog:

Parameters	Description	Values
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ l Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ l Inactive
Min. slope 1-8	The lower limit for the slope, in [%]. (100% refers to -59.16 mV/pH.)	10…200
Max. Slope 1-8	The upper limit for the slope, in [%].	10…200
Min. zero point 1-8	The lower limit for the zero point.	-100…100
Max. zero point 1-8	The upper limit for the zero point.	-100…100
Min. drift	The minimum drift value in [mV/30s].	-100 to 100
Max. drift	The maximum drift value in [mV/30s].	-100 to 100

Note

- If the values are within the limits, the sensor test is regarded as having been passed.
- Slope and drift relate to 25°C.

To provide an overview, the relevant method functions have been summarized and listed in the following table:

Method functions for the pH sensor test

Method function	Description
Sample (Calibration)	This method function is used firstly in order to carry out a calibration and secondly for the sensor test. It is selected via the "Action" parameter. Only two buffers can be defined for the sensor test.
Measure (normal)	The measured values of both calibration solutions (pH buffers) are determined here. In addition, another drift determination is carried out for the second buffer.
Calibration	In the method, the "Calibration" method function for the sensor test is placed after the "End of sample" method function. Essentially, "Calibration" corresponds to a calculation function. In the process, it calculates the calibration parameters from the measured values of the calibration loop and the calibration standard values (pH buffer values). These are then compared with the inputted limit values for the zero point, slope and drift.
Record	The results of the sensor test are displayed in the "Overview" section of the record. The various selection parameters for titration curves (E – V, dE/dV – V, etc.) which are available during standard titration are invalid for the record.

See also

Sample (calibration) ▶ Page 39

6.4.5 Titration stand

The method type determines which titration stands are available.

The following titration stands have no parameters that are specific for the titration stand.

- **Auto stand**
- **Manual stand**
- **Rondolino**

These titration stands are available for the following method types:

- **General titration**
- **Titer**
- **Calibration**

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Titration stand	Defines which titration stand is to be used.	List of available titration stands

6.4.6 Pump

You can use this method function to drain a reagent into a sample vessel.

Parameters	Description	Values
Auxiliary reagent	The auxiliary reagent to be added.	List of available auxiliary reagents
Volume	Defines the volume in [mL] to be pumped.	0…1000

6.4.7 Stir

Activates or deactivates (speed ="0") the stirrer of the current titration stand.

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100
Duration	The stirring time, in [sec]. After the stirring time has elapsed, the titrator will continue to the next method function without switching off the stirrer. The stirrer is switched off after the analyis is finished or the beaker is changed. The stirrer output is defined by the prior method function **Titration stand**.	0 … 10^5

6.4.8 Dispense (normal)

You can use this method function to dispense a precisely defined quantity of titrant.

The smallest increment (dV(min)) is 1/20000 of the burette volume, i.e. for the following burettes:

1 mL burette: dV(min) = 0.05 µL
5 mL burette: dV(min) = 0.25 µL
10 mL burette: dV(min) = 0.50 µL
20 mL burette: dV(min) = 1 µL

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-
Volume	Volume in [mL].	0.0001…1000

Dosing rate	Defines the dosing rate (not including the filling time), in [mL/min]. You can also select a burette type-dependent maximum number.	0.01…60

6.4.9 Measure (normal)

For the controlled acquisition of a measured value from a sensor. If a temperature sensor or a is selected for the measurement, the subfunction **Temperature acquisition** is omitted.

Subfunction: Sensor

Parameters	Description	Values
Type	The type of sensor to be used to perform the measurement.	mV I pH I ISE I Phototrode I Polarized I Temperature
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I pH I ppm I pM I pX I %T I A I µA I °C I K I °F
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Amperometric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Acquisition of Measured Values

Parameters	Description	Values
Acquisition	Defines how the measured value is acquired. **Equilibrium controlled**: The measured value is acquired as soon as it stabilizes. **Fix**: The measured value is acquired after a defined waiting period. **Set value**: The measured value is acquired as soon as it has exceeded, or fallen short of, a specific set value, or as soon as it is within a range defined by the lower and upper limits. (The Set Value option is not available if the method function is used within a **Sample (Calib)** loop.)	Equilibrium controlled I Fix I Set value

The following parameters are available for the sensor types: **mV**, **pH**, **ISE**, **Phototrode**, **Polarized**

Parameters	Description	Values
dE	Defines the measured value interval. As soon as the change in the measured value over the time period dt is less than dE, the measured value will be acquired. This occurs within the defined time interval of t(min) to t(max). dE is specified in the unchanged unit of the sensor per second: - mV for the mV sensor type, pH, ISE, phototrode and polarized voltametric sensor - µA for polarized sensor.	0.1 … 15
dt	Defines the time component, in [sec] for dE/dt. Only if **Acquisition** = **Equilibrium controlled**	1…150
t(min)	Earliest possible time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Equilibrium controlled**.	1…150
t(max)	Latest possible time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Equilibrium controlled**	$1…10^5$
Time	Waiting time, in [sec], before acquisition of a measured value. Only if **Acquisition** = **Fix**	$1…10^5$
Mode	Mode for the measured value acquisition of the "set value". **E > set value** acquires the measured value as soon as the set value has been exceeded. **E < set value** acquires the measured value as soon as the measured value falls below the set value. Not available within a calibration loop. Only for **Acquisition** = **Set value**.	E > set value I E < set value
Set value	Set value in the sensor unit. Measured values will be acquired after they exceed or fall below this value, depending on the mode setting. Only if **Acquisition** = **Set value**. Not available within a calibration loop.	(See "Value Ranges of Sensor Measuring Units and Control Band")
t(max)	Latest time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Set value**. Not available within a calibration loop.	$1…10^5$
Mean value	The system finds a mean value for the saved measured value, using a maximum of 10 measured values.	Activ I Inactive
No. of measured values	When you want to calculate a mean value, you can define the number of measured values used to find that mean value here.	1…10
dt	Defines the time interval, in [sec], for the measured value acquisition of the measured values to be averaged. Only if **Mean value** = **Active**	1…60

You can define the following parameters for the sensor type **Temperature**

Parameters	Description	Values
dT	Defines the measured value interval. As soon as the change in the measured value during the time period dt is less than dT, the measured value will be acquired. This occurs within the defined time interval of t(min) to t(max). This value is specified in the unchanged unit of the sensor, per second: °C I K I °F Only if **Acquisition** = **Equilibrium controlled**	0.1 … 10 Unit: °C I K I °F

dt	Defines the time component, in [sec] for dT/dt. Only if **Acquisition** = **Equilibrium controlled**	1…150
t(min)	Earliest possible time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Equilibrium controlled**.	1…150
t(max)	Latest possible time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Equilibrium controlled**	1…10^5
Time	Waiting time, in [sec], before acquisition of a measured value. Only if **Acquisition** = **Fix**	1…10^5
Mode	Mode for the measured value acquisition of the "set value". **T > set value**: acquires the measured value as soon as the set value has been exceeded. **T < set value**: value acquires the measured value as soon as the measured value falls below the set value. Not available within a calibration loop. **T within range**: acquires the measured value as soon as the measured temp. value is within the range including the limits. Only for **Acquisition** = **Set value**.	T > set value I T < set value I T within range I T within range
Set value	Set value in the sensor unit. Measured values will be acquired after they exceed or fall below this value, depending on the mode setting. Only if **Acquisition** = **Set value**. Not available within a calibration loop.	(See "Value Ranges of Sensor Measuring Units and Control Band")
Lower limit	Defines the lower limit for the temperature acquisition. Only appears if **Mode** = **T within range**.	-20.0…200.0
Upper limit	Defines the upper limit for the temperature acquisition. Only appears if **Mode** = **T within range**.	-20.0…200.0
t(max)	Latest time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Set value**. Not available within a calibration loop.	1…10^5
Mean value	The system finds a mean value for the saved measured value, using a maximum of 10 measured values.	Activ I Inactive
No. of measured values	When you want to calculate a mean value, you can define the number of measured values used to find that mean value here.	1…10
dt	Defines the time interval, in [sec], for the measured value acquisition of the measured values to be averaged. Only if **Mean value** = **Active**	1…60

6.4.10 Titration (EQP)

Carries out an equivalence-point titration. You can define the relevant parameters for the following subfunctions:

Subfunction: Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-

Subfunction: Sensor

Type	The type of sensor to be used to perform the measurement.	mV I pH I ISE I Phototrode I Polarized I Temperature
Sensor	Defines the sensor used to perform the measurement.	List of available sensors

Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I pH I ppm I pM I pX I %T I A I µA I °C I K I °F
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Amperometric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Frequency	Polarization frequency in [Hz]. The standard frequency is 4 Hz; other values should only be used for special applications. Only for **Type** = **Polarized**, and **Unit** = **mV**.	4 I 2 I 1 I 0.5
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Speed	Defines the stirring speed in [%].	0…100

Subfunction: Predispense

Parameters	Description	Values
Mode	Specifies the type of addition: **Volume**: predispenses a specific volume. **Potential**: system predispenses a substance until a certain potential is reached. **Factor**: A multiple of the sample size is predispensed. **None**: does not predispense.	Volume I Potential I Factor I None
Volume	Volume in [mL].	0.0001…1000
Potential	The potential at which predispensing is stopped. Only for **Mode** = **Potential**.	Depends on the sensor
Factor	The system calculates the predispensing volume by multiplying the factor by the sample size. Only if **Mode** = **Factor**	0 … 10^5
Wait time	Defines a waiting time, in [sec]. After predispensing or, if **Mode** = **None**, before the start of titration.	0…32000

Subfunction: Control

Parameters	Description	Values
Control	Here you can select from among three predefined control modes, or you can select **User** to define all the parameters as freely editable. If you change from **Normal**, **Fast**, **Cautious** to **User**, the system will copy over the predefined parameter settings and they will then be freely editable.	Normal I Fast I Cautious I User

Mode	Select an application depending on the sensor type. The selected application will then provide its own specific parameter set. Not available for **Control** = **User**.	Application list
Show parameters	Here you can select whether to display the preset parameters of the control modes **Normal**, **Fast** or **Cautious** as non-editable info fields. Not for **Control** = **User**.	Activ l Inactive
Titrant addition	Defines whether to always dispense the same volume defined by dV (**Incremental**) or to adjust the volume to be titrated per step as the titration progresses (**Dynamic**). Only for **Control** = **User**.	Dynamic l Incremental
dE(set value)	Defines the potential difference targeted per titrant addition. Only for **Control** = **User** and **Titrant addition** = **Dynamic**.	[mV/µA] 0.1…100 [mS/µS] 0.01…100
dT(set value)	Defines the temperature difference in the unit of the temperature sensor that is targeted for a temperature sensor per titrant addition. For **Control** = **User** and **Titrant addition** = **Dynamic** only.	0.1…100
dV(min)	Defines the minimum amount for a titrant addition, in [mL]. For **Control** = **User** and **Titrant addition** = **Dynamic** only.	0.0001…1
dV(max)	Defines the maximum amount for a titrant addition, in [mL]. For **Control** = **User** and **Titrant addition** = **Dynamic** only.	0.0001…10
dV	Defines the volume increment, in [mL], for the incremental titrant addition. For **Control** = **User** and **Titrant addition** = **Incremental** only.	0.0001…10
Meas. val. acquisition	Type of measuring value acquisition: **Equilibrium controlled**: The system acquires the measured value and makes the next titrant addition as soon as a stable measured value is established. **Fixed time**: The measured values acquisition and the titrant addition occur according to fixed time intervals. Only for **Control** = **User**.	Equilibrium controlled l Fixed time
dE	As soon as the change in the measured value during the time period **dt** is less than **dE**, the measured value will be acquired. Acquisition takes place no earlier than after **t(min)** and no later than after **t(max)**. Then the next titrant addition is conducted. For **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled** only.	[mV/µA] 0.1 … 15 [mS/µS] 0.01 … 15
dT	As soon as the change in the measured value during the time period **dt** is less than **dT**, the measured value will be acquired. Acquisition takes place no earlier than after **t(min)** and no later than after **t(max)**. Then the next titrant addition is conducted. For **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled** for a temperature sensor only.	1…150
dt	Defines the time interval, in [sec], for calculating dE/dt (or dT/dt for a temperature sensor). For **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled** only.	0.1…15
t(min)	Earliest possible time for the measured value acquisition, in [sec]. Only for **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled**.	0.5…150

t(max)	Latest possible time for the measured value acquisition, in [sec]. Only for **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled**.	1…10^5
dt	Defines the time interval, in [sec], for **Fixed time**. For **Control** = **User** and **Meas. val. acquisition** = **Fixed time** only.	0.5…6000

Subfunction: Evaluation and Recognition

Parameters	Description	Values
Procedure	Defines which evaluation procedure to use.	Standard I Asymmetric I Minimum I Maximum I Segmented
Threshold	Defines the threshold (absolute amount) that must be exceeded for the recognition of an EQP. **Procedure** = **Minimum** and **Maximum**: This threshold value refers to the original curve [UoM] **Procedure** = **Standard** and **Asymmetric**: It refers to the 1st derivative of the original curve [UoM*/mL]. **Procedure** = **Segmented**: It refers to the 2nd derivative of the original curve [UoM/mL].	Standard, Asymmetric and Segmented: 0 … 10^6 Minimum and Maximum: Depends on the sensor

* UoM: Unit of Measurement

Tendency	Defines the tendency for which the EQP is to be detected. For **Procedure** = **Standard**, **Asymmetric** and **Segmented**.	Positive I Negative I None
Ranges	You can define up to three recognition ranges. Outside these ranges, the system will recognize neither EQP's nor EQP candidates. Depending on what is defined here, upper and lower limits are defined for each recognition range and also whether additional EQP criteria are to be used for each recognition range.	1 I 2 I 3 I 0
Range type 1… 3	Defines the type of the definition range. **Potential**: each range is defined by an upper limit and a lower limit of a potential. **Volume**: each range is defined by an upper limit and a lower limit of a volume. **Potential & volume**: each range is defined by an upper limit and a lower limit of a potential and an upper and a lower limit of a volume.	Potential I Volume I Potential & volume
Lower limit potential 1…3	Defines the lower limit for the recognition range as potential. The unit of measure will depend on the sensor used.	Depends on the sensor
Upper limit potential 1…3	Defines the upper limit for the recognition range as potential. The unit of measure will depend on the sensor used.	Depends on the sensor
Lower limit volume 1…3	Defines the lower limit for the recognition range as volume.	1…1000 mL
Upper limit volume 1…3	Defines the upper limit for the recognition range as volume.	1…1000 mL

Add. EQP criteria	Defines whether to take additional EQP criteria into consideration. The available selection will depend on the evaluation procedure chosen. They can be defined individually for each recognition range or for the overall recognition range (**Ranges** = 0). **Last EQP**: The system only considers the quantity of EQPs defined. **Steepest jump**: The system only considers the number of steepest jumps defined. **Lowest value**: The system only considers the number of lowest values defined. **Highest value**: The system only considers the number of highest values defined.	Last EQP I Steepest jump I Lowest value I Highest value I No
Last jumps	The quantity of last jumps to be taken into consideration. Only for **Add. EQP criteria** = **Last EQP**.	1…9
Steepest jumps	The quantity of steepest jumps to be taken into consideration. Only for **Add. EQP criteria** = **Steepest jump**.	1…9
Lowest values	The quantity of lowest values to be taken into consideration. Only for **Add. EQP criteria** = **Lowest value**.	1…9
Highest values	The quantity of highest values to be taken into consideration. Only for **Add. EQP criteria** = **Highest value**.	1…9

Subfunction: Termination

Parameters	Description	Values
At Vmax	Defines the maximum volume, in [mL], at which the titration must be terminated if it has not been terminated already.	0.1…1000
At potential	Defines whether to terminate the titration after reaching a defined potential (with the correct tendency!).	Activ I Inactive
Potential	The potential at which to terminate the titration. The unit of measure will depend on the sensor used. Only if **At potential** = **Active**	-100 … 100 (See "Value Ranges of Sensor Measuring Units and Control Band")
Termination tendency	Defines for which tendency the titration should be terminated. Only for **At potential** = **Active**.	Positive I Negative I None
At slope	Defines whether to terminate the titration after reaching a defined slope. This absolute value must be exceeded by one measured value and then be greater than two measured values to result in termination.	Activ I Inactive
Slope	The slope, in [unit of measure/mL], at which to terminate the titration. Only if **At slope** = **Active**	0 … 10^5
After number of recognized EQPs	Specifies whether the titration should be terminated after the recognition of a specific quantity of EQP candidates. The EQP candidates must fulfill the following conditions: - It lies within the recognition range defined in **Ranges**. - It is above the threshold defined in **Threshold** - It show the correct tendency as defined in **Tendency**. If no additional EQP criteria should be considered, then EQP candidate = EQP applies.	Activ I Inactive
Number of EQPs	Defines the quantity of EQP candidates after the recognition of which the system should terminate the titration. Only if **After number of recognized EQPs** = **Active**	1…30

Combined termination criteria	**Inactive**: Termination as soon as the first of the selected criteria from the (**Potential** I **Slope** I **After number of recognized EQPs**) group has been fulfilled. **Active**: Termination as soon as all the selected criteria have been fulfilled. Termination of the titration in any case if the maximum volume is reached.	Activ I Inactive

6.4.11 Mode

An application mode can be selected in the **Control** subfunction for the EQP titration method functions if the **Control** setting is not set to **User**. Application modes are available for various types of titration (acid/base, redox, argentometry, etc.). If an application mode is selected, the settings for the Control subfunction will be specified based on what is best for the primary uses for the corresponding type of titration. The user can choose between three different parameter sets for each application mode (Control **Normal**, **Fast** and **Cautious**).

Sensor type	Unit	Unit for dE(set value) and dE	Mode
pH	pH	mV	Acid / Base
	mV		Acid / Base (non aqu.)
mV	mV	mV	Precipitation
			Precipitation (non aqu.)
			Redox
ISE	mV	mV	Precipitation
	ppm		
	pX		
	pM		
Phototrode	mV	mV	Precipitation
	%T		Complexation
	A		
Polarized	mV	mV	Redox
	µA	µA	Redox
Temperature	°C	°C, °F, K	Acid / Base
	°F		
	K		

6.4.12 Titration (EP)

Carries out an end-point titration. You can define the relevant parameters for the following subfunctions:

Subfunction: Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-

Subfunction: Sensor

Parameters	Description	Values
Type	The type of sensor to be used to perform the measurement.	mV I pH I ISE I Phototrode I Polarized I Temperature
Sensor	Defines the sensor used to perform the measurement.	List of available sensors

Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I pH I ppm I pM I pX I %T I A I µA I °C I K I °F
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Amperometric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Predispense

Parameters	Description	Values
Mode	Specifies the type of addition: **Volume**: predispenses a specific volume. **Potential**: system predispenses a substance until a certain potential is reached. **Factor**: A multiple of the sample size is predispensed. **None**: does not predispense.	Volume I Potential I Factor I None
Volume	Volume in [mL].	0.0001…1000
Potential	The potential at which predispensing is stopped. Only for **Mode** = **Potential**.	Depends on the sensor
Factor	The system calculates the predispensing volume by multiplying the factor by the sample size. Only if **Mode** = **Factor**	0 … 10^5
Wait time	Defines a waiting time, in [sec]. After predispensing or, if **Mode** = **None**, before the start of titration.	0…32000

Subfunction: Control

Parameters	Description	Values
End point type	Absolute: Titration is ended when the absolute measured value is reached. Relative: The system will take into consideration the difference between the desired end point and the measured value at the start of the titration.	Absolute I Relative
Tendency	Defines the direction of change for the measured value during the titrant addition. If the starting potential, end point and tendency are inconsistent at the start of the analysis, the system will terminate the analysis immediately. For **End point type** = **Absolute** only.	Positive I Negative I None

End point value	The defined titration end point. The unit will depend on the sensor used.	(See "Value Ranges from Sensor Measuring Units and Control Band")
Control band	This number defines the width of the control band. Outside the control band, the system will titrate with the maximum dispensing rate. The smaller the control band, the faster the titrator will react to a deviation from the potential of the defined end point. When the measurement curve reaches the control band, the titrator will slow down the titrant addition to approach the end point in a cautious manner. The unit will depend on the sensor used.	(See "Value Ranges from Sensor Measuring Units and Control Band")
Dosing rate (max)	The maximum dosing rate in [mL/min].	0.001…60
Dosing rate (min)	The minimum dosing rate in [µL/min].	1…10^4

Subfunction: Termination

Parameters	Description	Values
At EP	Defines whether to terminate the titration after reaching the end point. If **Inactive** is selected, after reaching the end point the system will continue acquiring measured values without adding titrant until the maximum time period is reached.	Activ I Inactive
Termination delay	The termination delay which defines the time period, in [sec], between reaching the end point and terminating the titration. If during the termination delay the measured value drops below the end point, the system will add further increments and restart the termination delay. (Only if "at EP" = "yes" is selected.)	0…10^8
At Vmax	Defines the maximum volume, in [mL], at which the titration must be terminated if it has not been terminated already.	0.1…1000
Max. time	Defines the maximum time of the titration, in [sec].	0…10^8 I ∞

6.4.13 Titration(LearnEQP)

Titration (Learn EQP) is used to determine the best parameters for carrying out an EQP titration. As soon as the settings have been successfully recorded, the titration detection in the method is converted to a **Titration (EQP)** with the recorded settings. If the analysis has more than one sample, the subsequent samples are titrated and analyzed with the recorded settings parameters.
You can determine the relevant parameters for the following subfunctions:

Subfunction: Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-

Subfunction: Sensor

Parameters	Description	Values
Type	The type of sensor to be used to perform the measurement.	mV I pH I ISE I Phototrode I I
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I pH I ppm I pM I pX I %T I A I µA I °C I K I °F
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

6.4.14 Calculation

Define limits for the results

If **Result limits** is activated, the titrator checks if the result falls within the limits defined in **Lower limit** and **Upper limit**. If the result lies outside the limits, it is marked as such.

Configure the action of the system if the result lies outside the limits

The table below shows the settings for the four possible actions of the system if the value of the result lies outside of the limits.

Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Parameter description

Parameters	Description	Values
Result type	**Predefined**: a predefined result from the proposal list has to be used and the parameters **Result unit**, **Formula**, and **Constant C=** cannot be changed. The parameters **Result**, **Result unit**, **Formula**, and **Constant C=** are adjusted automatically in accordance with the parameter settings in the method function **Sample**, **Sample (KF)** or **Sample (Standard Addition)** . **User defined**: All parameters can be changed. There is no automatic adjustment of the parameters **Result**, **Result unit**, **Formula**, and **Constant C=**	Predefined I User defined
Calculation type	Using this parameter you can perform calculations for the listed categories. For the selection of the result from the proposal list, you have to consider the Parameter **Entry type** used in the method function **Sample**. If there is a difference between **Calculation type** and **Entry type** in **Sample**, an error message appears.	Direct titration I Back titration autom. (only G20S) I Back titration manual I Blank comp. I 2nd titration function I Other

Formula Result Result unit Constant C=	These parameters are automatically set for result proposals if you have selected the parameter **Result type** = **Predefined** (these parameters depend on the selected **Calculation type** and the **Entry type** in the method function **Sample**. If you have selected **Result type** = **User defined** you can edit the parameters **Result**, **Result unit** and **Constant C=**. **Formula** is not editable.	Arbitrary I Constant C= only a number is allowed
Selected EQP	You can enter equivalence points (EQP) which you want to consider for the calculation. This parameter is only available if **Titration (EQP)** is selected in a loop.	1 ... 10
Auxiliary value	Defines which of the predefined auxiliary values shall be used in this calculation.	Aux. val. 1...3
Blank	Defines which of the predefined blank values shall be used in this calculation.	Blank 1...3
M [g/mol]	Defines the molar mass of the substance [g/mol]. Only in method function **GT** (general titration).	List of concentration/ titer standards and substances
z (Equivalent number)	Shows the equivalent number (z) of the molar mass entry. Only in method function **GT** (general titration).	-
Decimal places	The number of decimal places for the result.	0…6
Result limits	Defines whether limits should be observed for the result. If this function is activated, there will be a message in the record if the result falls outside the defined limits.	Activ I Inactive
Lower limit	Defines the lower limit of the result.	-10^8 ... 10^8
Upper limit	Defines the upper limit of the result.	-10^8...10^8
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ I Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ I Inactive
Record statistics	Specifies whether statistics should also be issued with the results in the report along with the result. The statistics are not printed, if in the method function **Record** the parameter **Results** is not selected.	Activ I Inactive

6.4.15 Record

This method function defines the type and scope of the data to be output for a record using the printer (see **Peripherals** > **Printer**.

If the method function **Record** is placed within a sample loop, the record will include all previous method functions within the current sample loop.

If the method function **Record** is placed outside of a sample loop, the record will include all previous method functions listed after the last sample loop in the method procedure. A few settings are not available outside of a loop.

Parameters	Description	Values
Summary	States whether or not a short summary of the results should appear at the top of the protocol.	Inactive I Per sample I Per series out of loop: Activ I Inactive
Results	The results from the **Calculation** method functions. Any statistic selected will be recorded after the last sample of a series or multiple determination.	within loop: Per sample I Per series I Inactive Out of Loop: Activ I Inactive
Raw results	The raw results produced during the determination	within loop: Per sample I Per series I No Out of Loop: Activ I Inactive

Table of measured values	The table of measured values of the current sample (not available out of loop).	Activ I Inactive
Sample data	The sample data of a sample loop. (Not available outside of loop)	Per sample I Per series I Inactive
Resource data	All data in the setup regarding the resources used in the method.	Per sample I Per series I Inactive
E - V	Titration curve of the current sample. The potential is plotted against the volume (not available out of loop).	Last titration function I All titration functions I Inactive
dE/dV - V	The 1st derivation of the titration curve, potential against volume (with linear coordinate representation) (not available out of loop).	Last titration function I All titration functions I Inactive
log dE/dV - V	The 1st derivative of the titration curve for potential against volume. (With logarithmic ordinate display) (not available outside of loop)	Last titration function I All titration functions I Inactive
d^2E/dV^2 - V	The 2nd derivative of the titration curve for potential against volume. (With linear coordinate display) (not available out of loop)	Last titration function I All titration functions I Inactive
E - t	Titration curve of the current sample. The potential is plotted versus the time. (Not available outside of loop)	Last titration function I All titration functions I Inactive
V - t	Titration curve of the current sample. The volume is plotted versus the time. (Not available outside of loop)	Last titration function I All titration functions I Inactive
dV/dt - t	The 1st Derivative of the titration curve volume against time" (not available out of loop).	Last titration function I All titration functions I Inactive
T - t	Titration curve of the current sample. The temperature is plotted versus the time. (Not available outside of loop)	Last titration function I All titration functions I Inactive
E - V & dE/dV - V	Two superposed titration curves **E - V** and **dE/dV - V** for the current sample. (Not available outside of loop)	Last titration function I All titration functions I Inactive
V - t & dV/dt - t	Two overlaid titration curves **V - t** and **dV/dt - t** of the current sample (not available out of loop).	Last titration function I All titration functions I Inactive
Method	Printout of the method used.	Activ I Inactive
Series data	All data from the series run.	Activ I Inactive
Calibration curve	The sensor unit of measurement is plotted against the measured values of all samples (not available within loop).	Activ I Inactive

6.4.16 End of sample

The **End of sample** method function closes a sample loop. A sample loop refers to the range of a method through which a sample series will pass for each sample. The commencement of a sample loop is specified using the **Sample** method function.

6.4.17 Titer

The **Titer** method function is only available outside a loop. This method function assigns the result of a sample loop to a titer and updates the value stored in Setup.

Define limits for the result assigned to the titer

If **Limits** is activated, the titrator checks if the result falls within the limits defined in **Lower limit** and **Upper limit**. If the result lies outside the limits, it is not assigned to the titer.

Configure the action of the system if the result lies outside the limits

The table below shows the settings for the four possible actions of the system if the value of the result lies outside of the limits.

Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Parameters	Description	Values
Titrant	Shows the titrant used in the method function.	-
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-
TITER=	Specifies for how many results the titer should be determined. (For i=1, i does not have to be defined.)	Mean[Ri], i=1…30
Limits	Determines whether limits should be taken into account for acquisition of a value. If the value is outside these limits, the value is not transferred to Setup.	Activ I Inactive
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ I Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ I Inactive
Lower limit	Defines the lower limit of a value. Only if **Limits** = **Active**	0…100
Upper limit	Defines the upper limit of the concentration limit. Only if **Limits** = **Active**	0.1…100

6.4.18 Calibration

This method function assigns the result of a calibration loop to a sensor and updates the sensor setup. Calibration is only performed outside a loop. This method function can be applied both for **Calibration** and **Sensor test**. The calibration can be performed for **Action** = **Calibration** in the **Sample (Calib)** method function and the sensor test for **Action** = **Sensor test**.

Define limits for the result assigned to the sensor

If **Limits** is activated, the titrator checks if the result falls within the limits defined in **Min. slope**, **Max. Slope**, **Min. zero point** and **Max. zero point**.

- If the result of a calibration lies outside the limits, it is not assigned to the sensor.
- If the result of a pH test lies outside the limits, the sensor does not pass the test.

Configure the action of the system if the result lies outside the limits

The table below shows the settings for the four possible actions of the system if the value of the result lies outside of the limits.

Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**

Action of the system	Message outside limits	Stop outside limits
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Parameters	Description	Values
Limits	Determines whether limits should be taken into account for acquisition of a value. If the value is outside these limits, the value is not transferred to Setup.	Activ I Inactive
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ I Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ I Inactive

Note

In cases of segmented calibration for pH and ISE sensors, the limits will be defined and observed for each segment.

Depending on the sensor type, if the **Limits** checkbox is activated, the following parameters can be determined (100% represents -59.16 mV/pH (sensor type: pH) or to -59.16 mV/[unit]) /Ion charge (sensor type: ISE). The unit corresponds to the unit specified in the previous method function, **Sample (Calib)**. (For temperature sensors, only the two info fields for the minimum and maximum zero point are displayed.)

For pH and ISE sensors:

Parameters	Description	Values
Min. slope 1-8	The lower limit for the slope, in [%]. (100% refers to -59.16 mV/pH.)	10…200
Max. Slope 1-8	The upper limit for the slope, in [%].	10…200
Min. zero point 1-8	The lower limit for the zero point.	-100…100
Max. zero point 1-8	The upper limit for the zero point.	-100…100

Note

The determined slope is converted to 25°C and compared with the limits.

Additional parameters for **Sensor test**:

Min. drift	The minimum drift value in [mV/30s].	-100 to 100
Max. drift	The maximum drift value in [mV/30s].	-100 to 100

6.4.19 Blank

This method function assigns a result or arbitrary value to a blank value, including the unit.

Define limits for the blank value

If **Limits** is activated, the titrator checks if the blank value falls within the limits defined in **Lower limit** and **Upper limit**. If the blank value lies outside the limits, it is marked as such.

Configure the action of the system if the blank value lies outside the limits

The table below shows the settings for the four possible actions of the system if the blank value lies outside of the limits.

Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Parameters	Description	Values
Name	Shows the name of the value.	Blank 1…3
Value B=	Here you can enter a number or you can select a formula from the proposal list (via the **Proposal** button).	1 … 120 I Mean value [R1…R3]
Unit	The units in which the blank is specified.	Arbitrary
Limits	Determines whether limits should be taken into account for acquisition of a value. If the value is outside these limits, the value is not transferred to Setup.	Activ I Inactive
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ I Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ I Inactive
Lower limit	Defines the lower limit of the value. Only if **Limits** = **Active**	-10^8 … 10^8
Upper limit	Defines the upper limit of the value. Only if **Limits** = **Active**	-10^8 … 10^8

6.4.20 Auxiliary value

This method function assigns a result or arbitrary value to an auxiliary value.

Define limits for the auxiliary value

If **Limits** is activated, the titrator checks if the auxiliary value falls within the limits defined in **Lower limit** and **Upper limit**. If the auxiliary value lies outside the limits, it is marked as such.

Configure the action of the system if the auxiliary value lies outside the limits

The table below shows the settings for the four possible actions of the system if the auxiliary value lies outside of the limits.

Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**

Action of the system	Message outside limits	Stop outside limits
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Parameters	Description	Values
Name	Shows the name of the value.	Aux. val. 1…3
Formula H=	Here you can enter a formula that will be used to convert the result of the sample loop to the auxiliary value. You can also enter a number or an auxiliary value.	Formula I Auxiliary value I Number
Limits	Determines whether limits should be taken into account for acquisition of a value. If the value is outside these limits, the value is not transferred to Setup.	Activ I Inactive
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ I Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ I Inactive
Lower limit	Defines the lower limit of the value. Only if **Limits** = **Active**	-10^8 … 10^8
Upper limit	Defines the upper limit of the value. Only if **Limits** = **Active**	-10^8 … 10^8

6.4.21 Auxiliary instrument

This method function activates external auxiliary instruments and enables the titrator to be controlled by such auxiliary instruments. The parameters described in the following can be defined for all control types. These are followed by parameters that can be defined explicitly for the relevant control type:

Parameters	Description	Values
Control type	The control type of the auxiliary instrument.	Output 24 V I Stirrer I Out TTL (Single pin) I Input TTL (Single pin) I RS-232
Name	Specify a descriptive name of your choice.	Arbitrary

6.4.21.1 Control type: 24V output

Parameters	Description	Values
Mode	Defines the mode for controlling the control output. **Fixed time**: The control output is switched on for the defined time interval. **On** I **Off**: The control outlet is switched on or off. After a sample series the control outlet is automatically switched off.	On I Off I Fixed time
Time	A time span in [sec] can be defined here for which the control outlet should be switched on. Only if **Mode** = **Fixed time**.	0…10^6

6.4.21.2 Control type: Stirrer

Parameters	Description	Values
Mode	Defines the mode for controlling the control output. **Fixed time**: The control output is switched on for the defined time interval. **On** I **Off**: The control outlet is switched on or off. After a sample series the control outlet is automatically switched off.	On I Off I Fixed time

Time	A time span in [sec] can be defined here for which the control outlet should be switched on. Only if **Mode** = **Fixed time**.	0…10^6
Speed	Defines the stirring speed in [%].	0…100

6.4.21.3 Control type: Out TTL (Single pin)

Parameters	Description	Values
Mode	Defines the mode for controlling the control output. For TTL signals, the number and type of the output signals is determined. **Fixed time**: The control output is switched on for the defined time period. **On** | **Off**: The control output is switched on or off. **Input controlled**: A signal received at the control inlet controls the control outlet. The Auxiliary instrument function is terminated as soon as the signal changes at the control input or after a defined maximum time has expired. **Sequential**: The control output runs through a defined sequence.	On | Off | Fixed time | Input controlled | Sequential
Time	A time span in [sec] can be defined here for which the control outlet should be switched on. Only if **Mode** = **Fixed time**.	0…10^6
Input	Select the auxiliary instrument to serve as the signal input (control input). Only if **Mode** = **Input controlled**.	Auxiliary instrument
Output signal	**Normal**: The signal is transmitted without conversion. **Inverted**: The signal is transmitted in inverted form. Only if **Mode** = **Input controlled**.	Normal | Inverted
Max. time	The maximum waiting time for a signal change, in [sec]. After it expires, the method is continued even if no signal change was detected. Only for signal inputs.	0…10^6
Number of pulses	The number of impulses in the planned sequence. Only if **Mode** = **Sequential**.	0…10^4
Pulse duration	The duration of a pulse in [sec] (time switched on + time switched off). Only if **Mode** = **Sequential**.	0…10^6
Interval	Defines the time span, in [sec], between two impulse starts. Only if **Mode** = **Sequential**.	0…10^6 | 0…10^4

6.4.21.4 Control type: TTL input (single pin)

Parameters	Description	Values
Input signal	Indicates whether an rising or a falling input signal should be detected.	Rising | Falling
Max. time	The maximum waiting time for a signal change, in [sec]. After it expires, the method is continued even if no signal change was detected. Only for signal inputs.	0…10^6

6.4.21.5 Control type: RS-232

Parameters	Description	Values
Send output sequence	Defines whether an output sequence should be sent.	Activ | Inactive

Output sequence	The control sequence for the signal receiver - can also contain a formula enclosed in characters % or control characters in format \xxx where xxx is the decimal number of the control character. G10 and G20 support only %R1% or %R2%. (Only if "Send output sequence" is activated).	%R%
Wait for response	Defines whether the system should wait for a response sequence from the device.	Activ I Inactive
Max. time	The maximum waiting time for an input sequence in [sec]. After it expires, the method will be continued even if no input sequence was detected. Only if **Wait for input sequence** = **Active**.	0…10^6 I ∞
Input sequence	The response sequence from the external device. Only if **Wait for response** = **Active** was selected.	Arbitrary

6.4.22 Drain

You use this method function to drain a specific volume from a sample vessel using a pump (membran -, peristalitc- or air pump (Solvent Manager).You can specify the following parameters:

Parameters	Description	Values
Drain pump	Defines, which pump is used for draining.	Available pumps
Drain volume	The volume to be drained, in [mL]. Not if **Drain pump** = **Solvent Manager**.	0…1000
Duration	The duration to drain the solvent , in [sec]. Only available if **Drain pump** = **Solvent Manager**.	0…10^3

7 Series Templates

You can use series templates to gather up to 303 individual samples to form a **Sample series**. All samples in the series are analyzed one after the other with a defined method (analysis template for sequential processing of samples using the same method).

Note

- You can create a shortcut on the Homescreen for all series templates.
- A maximum of 60 sample series can be stored in the titrator.

If you select a series template from this list by clicking on it, you can change its parameters or delete the entire template.

Navigation: **New** > **Series templates**

Parameters	Description	Values
Sample series ID	Here you can assign any ID to the sample series.	Arbitrary
Method ID	Here you can select the Method ID for the relevant method.	Method list
Comment	You can enter a brief comment about the series.	Arbitrary
Number of samples	Defines the number of samples to be analyzed. The number depends on the selected titration stand.	1…303
Number of standards	The number of standards to be analyzed with a method or series.	1…303
Number of buffers	The number of buffers to be used for the calibration of a pH sensor.	1…9

During the creation of a sample series, you can choose **Samples** to display the loop list (method type: **GT**) or to the standard list (method type **Titer** and **Calibration**). From these lists, you can change predefined sample or standard data or you can create new sample or standards.

7.1 Sample or Standard Parameters

The sample list, which can be opened by choosing **Samples** in the series parameter window, displays all samples of a loop with a number, the first ID, and the sample size (depending on entry type - see "Method functions: Sample"). You can also edit the samples here.

Note

- Series IDs must be unique, although sample IDs do not have to be.
- For titer loops, the standard name and the sample size are listed, and for calibration loops the name of the list of standards and the individual standards.

Select an entry from the list. You can define the following parameters for each sample, depending on the type of the loop (Sample, Titer, Calibration):

Parameters	Description	Values
Number	Defines the number of the sample.	1…303
ID	A user-defined name for the ID of the sample, in accordance with the "Sample" method function.	Arbitrary
Sample size	You can enter the sample size here. For fixed entry types, this field only appears as an info field.	0…1000 [g] I [mL] 0…10^6 [pcs.]

*The entered value of the sample size has to be valid within the range which is configured in the **Sample** method function of the relevant method.

Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000
Density	The density of the sample for the entry types "Weight", "Fixed weight", "Volume" and "Fixed volume".	0.0001…100
Comment	You can enter a brief comment about the series.	Arbitrary
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6

Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

Note

For entering the sample parameters, particularly for numerous samples, the titrator provides you with assistance in the entry windows of the **ID 1** and **Sample size** parameters:

These extra icons are a quick, direct way to jump to the entry window of the previous sample or next sample.

You can also choose **Sample ID 1** and "**Sample size**" to switch directly between the entry windows for the sample parameters **ID 1** and **Sample size**.

8 Calculation and Results

The method functions "Titration (EP)" and "Titration (EP)", Measure (normal) and Dispense provide their own raw results within a method. These raw results are saved by the titrator in the order in which the generating method functions are processed within the method.

Example: Sequence of the calculations in the method, generating two results

Method function	Result
Title	
Sample	
Titration stand	
Stir	
Titration (EQP)	
Calculation	R1
Calculation*	R2
End of sample	

*: Allowed are a maximum of two "Calculation" method functions, which can either be inserted within a loop as well as outside of a loop.

The definitions to the parameters you can determine in the "Calculation" method function are available in "Methods: Method functions > Calculation"

8.1 Symbols for calculations

Inside the method function **Calculation**, you can access certain analysis data (**Raw results**, **Results**, **Resource data** and **Sample data**) via the different symbols. The following is a list of the symbols used for the G20. The list also contains additional symbols which are used in the records.

Sample data

Symbol	Meaning
pw(-E)	The ionic concentration in [mol/L], [E=pH, pX, pM].
m	The sample size [g, ml, pcs].
d	The density of a sample or a standard [g/mL].
wp	The weight per piece [g].
f	A correction factor as defined in the sample method function.

Resource data

Symbol	Meaning
B[Blank]	A blank.
c	Specifies the nominal concentration of a titrant used for a titration method function [mol/L].
cst	The concentration of a liquid titer standard [mol/L].
d	The density of a sample or a standard [g/mL].
H[AuxValue]	An auxiliary value.
M	The molar weight of a substance [g/mol]. As defined in the setup.
p	The purity of a solid titer standard [%].
z	The equivalent number of a substance. As defined in the setup.

Raw results

Symbol	Meaning
C	A constant that uniquely belongs to the result Rx. It cannot be used in this form for the calculations of other results. For information on using **Constant C=**, refer to "Results: results proposal lists".
E	The measured potential of a method function **Measure (normal)** [mV, pH…].

Symbol	Meaning
Q	Substance quantity used up to the end point or equivalence point of a titration method function [mmol].
QE(H[AuxValue])	Consumption up to the auxiliary value in [mmol].
QEND	The total substance quantity used up to the end of a titration method function [mmol].
QENDDi	The total substance quantity in [mmol] used during a dispensing method function.
T	The measured temperature in a **Measure (normal)** method function (direct measurement with temperature sensor or concomitant temperature acquisition) [°C], [K], [°F].
VEND	Titrant volume used up to the end of a titration method function [mL].
VEQ (=V)	Titrant consumption up to the end point or equivalence point of a titration method function. For multiple equivalence points, the consumption is calculated from the previous equivalence point [mL].
VEX	The excess of titrant added after reaching the end point or equivalence point of a titration method function [mL].
VE(x)	The titrant volume used until the potential x is reached during a titration method function [mL].

Results

Symbol	Meaning
Rx	A result x.
Mean[Rx]	The mean value of a result Rx.

8.2 Calculation formulas

Calculation formulas are used in the "Calculate" method function.

One typical example for a formula within the "Calculation" method function would be the expression R=VEQ. In this case, the consumed volume of titrant up to the point at which the end point is reached is assigned to R. All the symbols can be used for analysis data in relations like this. The analysis data to be used must be generated by the method before the "Calculate" method function.

Auxiliary values and blanks defined in the setup can generally be used in formulas in the same manner as symbols. The general form for an auxiliary value is: H[Name] (as defined in the setup).

8.3 Results proposal lists

Proposal list

In the **Calculation** dialog window (see "Methods: Method functions > Calculation"), using the **Result proposals** button, specified results with unit, formula and constants can be selected.

Proposal lists for the **Sample** and **Sample (Titer)** method functions are dependent on the **Entry type** parameter. When the **Entry type** is modified, a validation is immediately carried out to determine whether the selected calculation exists in the corresponding entry type.

Result type: Predefined

After selecting a result from the proposal list, the **Result unit**, **Formula** and **Constant C=** fields are automatically populated and can not be modified. The values for **Result**, **Result unit** and **Entry type** defined in the **Sample** method function are used to determine the value for **Formula**.

Result type: User defined

If the parameter **Result type** is set to **User defined**, you can modify **Result**, **Result unit** and **Constant C=**; but not **Formula**.
The mode **User defined** only offers empty proposal lists. A result can only be selected in **Predefined** mode. If you switch the mode to **User defined**, a number can be entered for **Constant C=**.

The proposal lists inside and outside a loop are different. Inside a loop and if **Result type** is set to **Predefined**, **Calculation type** can also be selected (**Direct titration**, **Back titration autom.**, **Blank comp.**, **2nd titration function**, **Others**).

Note

An auxiliary value exists in the setup. This can not be deleted, nor can addition auxiliary values be created. The name of the auxiliary value is fixed.

The different proposal lists are displayed as follows:

8.3.1 Result proposals inside of loops

8.3.1.1 Result proposals for "Calculation type=Direct titration"

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample** method function.

Result	Unit	Formula R=	Constant C=
Consumption	mL	VEQ	1
	mmol	Q	
	mL	VEQ*f	
	mmol	Q*f	
Total consumption	mmol	QEND	
Consumption until pot.	mmol	QE(H[AuxValue])	

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Weight** or **Fixed weight**.

Result	Unit	Formula R=	Constant C=
Consumption	mL/g	VEQ/m	1
Content	mg/g	Q*C/m	M/z
	mg/kg	Q*C/m	M*1000/z
	mol/kg	Q*C/m	1/z
	mmol/g	Q*C/m	1/z
	mmol/kg	Q*C/m	1000/z
	ppm	Q*C/m	M*1000/z
	%	Q*C/m	M/(10*z)
	g/100g	Q*C/m	M/(10*z)
	g/kg	Q*C/m	M/z
	mg/100g	Q*C/m	100*M/z
	mg KOH/g	Q*C/m	1
	mL/g	VEQ*f/m	1
	mmol/g	Q*f/m	1
Content	g/L	Q*C/(m/d)	M/z
	g/100mL	Q*C/(m/d)	M/(10*z)
	mg/L	Q*C/(m/d)	M*1000/z
	mg/100mL	Q*C/(m/d)	M*100/z
	mol/L	Q*C/(m/d)	1/z
	eq/L	Q*C/(m/d)	1
	meq/L	Q*C/(m/d)	1,000
	mmol/L	Q*C/(m/d)	1000/z
Acidity	°T	Q*f/(m*0.1)	1

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Volume** or **Fixed volume**.

Result	Unit	Formula R=	Constant C=
Consumption	mL/mL	VEQ/m	1
Content	mg/g	Q*C/(m*d)	M/z
	mg/kg	Q*C/(m*d)	M*1000/z
	mol/kg	Q*C/(m*d)	1/z
	mmol/g	Q*C/(m*d)	1/z
	mmol/kg	Q*C/(m*d)	1000/z
	ppm	Q*C/(m*d)	M*1000/z
	%	Q*C/(m*d)	M/(10*z)
	g/100g	Q*C/(m*d)	M/(10*z)
	g/kg	Q*C/(m*d)	M/z
	mg/100g	Q*C/(m*d)	100*M/z
	mg KOH/g	Q*C/(m*d)	1
	mL/g	VEQ*f/(m*d)	1
	mmol/g	Q*f/(m*d)	1
Content	g/L	Q*C/m	M/z
	g/100mL	Q*C/m	M/(10*z)
	mg/L	Q*C/m	M*1000/z
	mg/100mL	Q*C/m	M*100/z
	mol/L	Q*C/m	1/z
	eq/L	Q*C/m	1
	meq/L	Q*C/m	1,000
	mmol/L	Q*C/m	1000/z
Acidity	°T	Q*f/((m*d)*0.1)	1

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Pieces** or **Fixed pieces**.

Result	Unit	Formula R=	Constant C=
Content	mg/g	Q*C/(m*wp)	M/z
	mg/kg	Q*C/(m*wp)	M*1000/z
	mol/kg	Q*C/(m*wp)	1/z
	mmol/g	Q*C/(m*wp)	1/z
	mmol/kg	Q*C/(m*wp)	1000/z
	ppm	Q*C/(m*wp)	M*1000/z
	%	Q*C/(m*wp)	M/(10*z)
	g/100g	Q*C/(m*wp)	M/(10*z)
	g/kg	Q*C/(m*wp)	M/z
	mg/100g	Q*C/(m*wp)	100*M/z
	mg KOH/g	Q*C/(m*wp)	1
	mL/g	VEQ*f/(m*wp)	1
	mmol/g	Q*f/(m*wp)	1
Acidity	°T	Q*f/((m*wp)*0.1)	1

8.3.1.2 Result proposals for "Calculation type=Automatic back titration"

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample** method function.

Result	Unit	Formula R=	Constant C=
Consumption	mL	VEQ	1
	mmol	Q	1

Result	Unit	Formula R=	Constant C=
Total consumption	mmol	QEND	1
Consumption until pot.	mmol	QE(H[AuxValue])	1

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Weight** or **Fixed weight**.

Result	Unit	Formula R=	Constant C=
Consumption	mL/g	VEQ/m	1
Content	mg/g	(QENDDi-Q)*C/m	M/z
	mg/kg		M*1000/z
	mol/kg		1/z
	mmol/g		
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		
	g/kg		M/z
	mg/100g		100*M/z
Content	g/L	(QENDDi-Q)*C/(m/d)	M/z
	g/100mL		M/(10*z)
	mg/L		M*1000/z
	mg/100mL		M*100/z
	mol/L		1/z
	eq/L		1
	meq/L		1,000
	mmol/L		1000/z

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Volume** or **Fixed volume**.

Result	Unit	Formula R=	Constant C=
Consumption	mL/mL	VEQ/m	1
Content	mg/g	(QENDDi-Q)*C/(m*d)	M/z
	mg/kg		M*1000/z
	mol/kg		1/z
	mmol/g		
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		
	g/kg		M/z
	mg/100g		100*M/z
Content	g/L	(QENDDi-Q)*C/m	M/z
	g/100mL		M/(10*z)
	mg/L		M*1000/z
	mg/100mL		M*100/z
	mol/L		1/z
	eq/L		1
	meq/L		1,000
	mmol/L		1000/z

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Pieces** or **Fixed pieces**.

Result	Unit	Formula R=	Constant C=
Content	mg/g	(QENDDi-Q)*C/(m*wp)	M/z
	mg/kg		M*1000/z
	mol/kg		1/z
	mmol/g		
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		
	g/kg		M/z
	mg/100g		100*M/z

8.3.1.3 Result proposals for "Calculation type=Manual back titration"

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample** method function.

Result	Unit	Formula R=	Constant C=
Consumption	mL	VEQ	1
	mmol	Q	1
Total consumption	mmol	QEND	1
Consumption until pot.	mmol	QE(H[AuxValue])	1

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Weight** or **Fixed weight**.

Result	Unit	Formula R=	Constant C=
Consumption	mL/g	VEQ/m	1
Content	mg/g	(H[AuxValue] –Q) * C/m	M/z
	mg/kg		M*1000/z
	mol/kg		1/z
	mmol/g		1/z
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		1/z
	g/kg		M/z
	mg/100g		100*M/z
Content	g/L	(H[AuxValue]–Q) * C/(m/d)	M/z
	g/100mL		M/(10*z)
	mg/L		M*1000/z
	mg/100mL		M*100/z
	mol/L		1/z
	eq/L		1
	meq/L		1,000
	mmol/L		1000/z
Rebelein	g/L	(H[AuxValue]-Q)*C/(f*(m/d))	1000

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Volume** or **Fixed volume**.

Result	Unit	Formula R=	Constant C=
Consumption	mL/mL	VEQ/m	1
Content	mg/g	(H[AuxValue] –Q) * C/(m*d)	M/z
	mg/kg		M*1000/z
	mol/kg		1/z
	mmol/g		1/z
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		1/z
	g/kg		M/z
	mg/100g		100*M/z
Content	g/L	(H[AuxValue]–Q) * C/m	M/z
	g/100mL		M/(10*z)
	mg/L		M*1000/z
	mg/100mL		M*100/z
	mol/L		1/z
	eq/L		1
	meq/L		1,000
	mmol/L		1000/z
Rebelein	g/L	(H[AuxValue]-Q)*C/(f*m)	1000

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Pieces** or **Fixed pieces**.

Result	Unit	Formula R=	Constant C=
Content	mg/g	(H[AuxValue] –Q) * C/(m*wp)	M/z
	mg/kg		M*1000/z
	mol/kg		1/z
	mmol/g		1/z
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		1/z
	g/kg		M/z
	mg/100g		100*M/z

8.3.1.4 Result proposals for "Calculation type=Blank-compensated"

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample** method function.

Result	Unit	Formula R=	Constant C=
Consumption	mL	VEQ	1
	mmol	Q	
Total consumption	mmol	QEND	
Consumption until pot.	mmol	QE(H[AuxValue])	

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Weight** or **Fixed weight**.

Result	Unit	Formula R=	Constant C=
Consumption	mL/g	VEQ/m	1

Result	Unit	Formula R=	Constant C=
Content	mg/g	(Q–B[Blank]) * C/m	M/z
	mg/kg		M*1000/z
	mol/kg		1/z
	mmol/g		1/z
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		M/(10*z)
	g/kg		M/z
	mg/100g		100*M/z
	mg KOH/g	(QE(H[AuxValue])-B[Blank]) * C/m	M/z
	meq/kg	(Q-B[Blank])*1000/m)	1
Bromine number	g/100g	(QEND-B[Blank])*C/m	M/(10*z)
Calculation	g/mol	1000*m/((Q-B[Blank])*f	1
Content	g/L	(Q–B[Blank]) * C/(m/d)	M/z
	g/100mL		M/(10*z)
	mg/L		M*1000/z
	mg/100mL		M*100/z
	mol/L		1/z
	eq/L		1
	meq/L		1,000
	mmol/L		1000/z

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Volume** or **Fixed volume**.

Result	Unit	Formula R=	Constant C=
Consumption	mL/g	VEQ/m	1
	mL/mL	VEQ/m	
Content	mg/g	(Q–B[Blank]) * C/(m*d)	M/z
	mg/kg		M*1000/z
	mol/kg		1/z
	mmol/g		1/z
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		M/(10*z)
	g/kg		M/z
	mg/100g		100*M/z
	mg KOH/g	(QE(H[AuxValue])-B[Blank]) * C/(m*d)	M/z
	meq/kg	(Q-B[Blank])*1000/(m*d)	1
Bromine number	g/100g	(QEND-B[Blank])*C/(m*d)	M/(10*z)
Calculation	g/mol	1000*(m*d)/((Q-B[Blank])*f	1

Result	Unit	Formula R=	Constant C=
Content	g/L	(Q–B[Blank]) * C/m	M/z
	g/100mL		M/(10*z)
	mg/L		M*1000/z
	mg/100mL		M*100/z
	mol/L		1/z
	eq/L		1
	meq/L		1,000
	mmol/L		1000/z

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Pieces** or **Fixed pieces**.

Result	Unit	Formula R=	Constant C=
Content	mg/g	(Q–B[Blank]) * C/(m*wp)	M/z
	mg/kg		M*1000/z
	mol/kg		1/z
	mmol/g		1/z
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		M/(10*z)
	g/kg		M/z
	mg/100g		100*M/z
	mg KOH/g	(QE(H[AuxValue])-B[Blank]) * C/(m*wp)	M/z
	meq/kg	(Q-B[Blank])*1000/(m*wp)	1
Bromine No.	g/100g	(QEND-B[Blank])*C/(m*wp)	M/(10*z)

8.3.1.5 Result proposals for "Calculation type=2nd titration function"

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample** method function.

Result	Result unit	Formula R=	Constant C=
Consumption	mL	(VEQ[2] + VEX)	1
		(VEQ[2] + VEND)	
	mmol	(Q[2] + QEX)	
		(Q[2] + QEND)	
	mL	(VEQ[2] + VEX)*f	
		(VEQ[2] + VEND)*f	
	mmol	(Q[2] + QEX)*f	
		(Q[2] + QEND)*f	
Total consumption	mmol	QEND[2] + QEX	
		QEND[2] + QEND	
Consumption until pot.	mmol	QE(H[AuxValue])[2] + QEX	
		QE(H[AuxValue])[2] + QEND	

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Weight** or **Fixed weight**.

Result	Result unit	Formula R=	Constant C=
Consumption	mL/g	(VEQ[2] + VEX)/m	1
		(VEQ[2] + VEND)/m	

Result	Result unit	Formula R=	Constant C=
Content	mg/g	(Q[2] + QEX)*C/m	M/z
	mg/kg	and	M*1000/z
	mol/kg	(Q[2] + QEND)*C/m	1/z
	mmol/g		1/z
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		M/(10*z)
	g/kg		M/z
	mg/100g		100*M/z
Content	g/L	(Q[2] + QEX)*C/(m/d)	M/z
	g/100mL	and	M/(10*z)
	mg/L	(Q[2] + QEND)*C/(m/d)	M*1000/z
	mg/100mL		M*100/z
	mol/L		1/z
	eq/L		1
	meq/L		1,000
	mmol/L		1000/z
	mL/g	(VEQ[2] + VEX)*f/m	1
		(VEQ[2] + VEND)*f/m	
	mmol/g	(Q[2] + QEX)*f/m	1
		(Q[2] + QEND)*f/m	

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Volume** or **Fixed volume**.

Result	Result unit	Formula R=	Constant C=
Consumption	mL/mL	(VEQ[2] + VEX)/m	1
		(VEQ[2] + VEND)/m	
Content	mg/g	(Q[2] + QEX)*C/(m*d)	M/z
	mg/kg	and	M*1000/z
	mol/kg	(Q[2] + QEND)*C/(m*d)	1/z
	mmol/g		1/z
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		M/(10*z)
	g/kg		M/z
	mg/100g		100*M/z

Result	Result unit	Formula R=	Constant C=
Content	g/L	(Q[2] + QEX)*C/m	M/z
	g/100mL	and	M/(10*z)
	mg/L	(Q[2] + QEND)*C/m	M*1000/z
	mg/100mL		M*100/z
	mol/L		1/z
	eq/L		1
	meq/L		1,000
	mmol/L		1000/z
	mL/g	(VEQ[2] + VEX)*f/(m*d)	1
		(VEQ[2] + VEND)*f/(m*d)	
	mmol/g	(Q[2] + QEX)*f/(m*d)	1
		(Q[2] + QEND)*f/(m*d)	

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Pieces** or **Fixed pieces**.

Result	Result unit	Formula R=	Constant C=
Content	mg/g	(Q[2] + QEX)*C/(m*wp)	M/z
	mg/kg	and	M*1000/z
	mol/kg	(Q[2] + QEND)*C/(m*wp)	1/z
	mmol/g		1/z
	mmol/kg		1000/z
	ppm		M*1000/z
	%		M/(10*z)
	g/100g		M/(10*z)
	g/kg		M/z
	mg/100g		100*M/z
	mL/g	(VEQ[2] + VEX)*f/(m*wp)	1
		(VEQ[2] + VEND)*f/(m*wp)	
	mmol/g	(Q[2] + QEX)*f/(m*wp)	1
		(Q[2] + QEND)*f/(m*wp)	

8.3.1.6 Result proposals for "Calculation type=Others"

For **Calibration**, the results proposals for **Calculation type**=**Others** also apply.

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample** method function.

Result	Unit	Formula R=	Constant C=
Potential	mV	E	1
pH	pH		
Ion conc.	pX		
	pM		
	ppm		
Absorption	A		
Transmission	%T		
Current	µA		
Temperature	°C	T	1
	K		
	°F		

Result	Unit	Formula R=	Constant C=
Ion conc.	mmol/L	pw(-E)*1000	1
	mol/L	pw(-E)	
Initial potential	pH	EST	

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Volume** or **Fixed volume**.

Result	Unit	Formula R=	Constant C=
TAC	mg/L $CaCO_3$	(20/m)*VE(5.0)*250	1
FOS	mg/L CH_3COOH	(((20/m)*(VE(4.4)-VE(5.0))*1.66)-0.15)*500	
FOS/TAC	–	R2/R1	

8.3.1.7 Result proposals for the method type "Titer"

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Weight** or **Fixed weight**.

Result	Unit	Formula R=	Constant C=
Titer	--	m/(VEQ*c*C)	M/(10*p*z)
	--		d/(cst*z)

The result proposals in the following table are valid if the **Entry type** parameter in the **Sample** method function is set to **Volume** or **Fixed volume**.

Result	Unit	Formula R=	Constant C=
Titer	--	m/(VEQ*c*C)	1/(cst*z)

8.3.2 Result proposals outside of loops

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample** method function.

Result	Unit	Formula R=	Constant C=
Mean value	--	Mean[R1]	1
Mean value	--	Mean[R2]	1
Mean value	--	Mean[R3]	1

8.4 Results

The **Results** dialog can be accessed directly from Homescreen using the relevant button.

Note

- The system only saves the results from the last analysis (series or individual sample).
- When you start a new analysis, you will lose the results from the previous analysis.
- You can see the results immediately after they are generated.

You can use the various buttons in the "**Results**" dialog to access different functions. You can, for example,

- view all results of the last analysis
- view statistics, perform an outlier test and if necessary, exclude samples from the statistics.
- perform recalculations for results in which certain raw data (e.g. sample sizes) have to be adapted retrospectively for a single sample or for all samples in a series.
- view and print the status and the calculated results of each individual sample.

Results are retained until new results are generated by methods. The results of the "older" of the two sample series are replaced.

All the changes performed on the saved results can be reversed with the "**Undo changes**" button.

Note

Changes to results are indicated by an asterisk in the record. Example: VEQ*.

All results

You can use the **All Results** button to view the results of the last analysis and print them if a printer is connected to the titrator (see "Printer").

From the **Results** dialog, you also have the following additional options:

- **Samples** View or print the results of an individual sample or exclude the entire sample (see "Results: Samples")
- **Statistics** Switch to the "Statistics" dialog (see "Results: Statistics")

Delete all results

You can use this button to delete all the data (raw data, raw results, and results) saved by the titrator in the results range.

Undo changes

If you make changes to the results saved by the titrator after the analysis, you can use **Undo all** to discard them. Afterward, the system will reinstate the initial status directly after the conclusion of the analysis, in its original and unchanged state.

Statistics

For results within a sample loop, you can display and print out statistics.

Note

The statistics are only created if more than one sample was analyzed in the corresponding loop.

The following calculated values will be displayed as statistical components:

- Mean value x `of a result` Rx (Mean [Rx])
- Standard deviation `s`
- Relative standard deviation `srel`
- Number of samples per loop `nTOT`

If a result was excluded from the statistics, all the results from that sample will always be excluded as well. The system will then recalculate the statistics without the excluded sample and label them accordingly. If the sample's results are then put back into the statistical evaluation, the label will be removed from the statistics.

From the **Statistics** dialog, you also have the following additional options:

- **Samples** View, print, or exclude the results of an individual sample (see "Samples")
- **Results** View or print all results (see "All Results")
- **Outlier test** Perform a test for outliers in the statistical evaluation.

Samples

You can use the **Samples** button to display and print the status and calculated results for each individual sample. The same applies for a series of additional data sets that can be accessed via "**Data**". This will let you view and print the sample, method and resource data for each sample and view and print the raw results and the measured values.

You can use the **Exclude** button in the Results: **Samples** dialog to exclude individual samples from the statistical evaluation. The system will not delete the results of the samples excluded in this way but merely label them as excluded. They will no longer be included in the statistics. Samples that have been excluded can be returned to the statistics at any time by choosing "**Include**".

After a sample is excluded, all affected calculations (inside and outside of loops) are performed again.

Outlier test

If the results of individual samples in a measurement series deviate greatly from the calculated mean value, it may make sense to question the significance of these (few) results and treat them as "outliers".

Outliers will have the following effects on the overall result of an analysis:

- The mean value is significantly shifted higher or lower.
- The standard deviation is increased.
- The distribution of the individual values around the mean value is distorted and no longer follows a normal distribution.

The titrator has an automatic function for identifying and labeling outliers. You can call this function from the **Statistics dialog** using the "**Outlier test**" softkey.

Note

You can run an outlier test if you have the results from more than three samples.

The procedure used by the titrator is the Grubbs outlier test. For this procedure, the measured value [x*] that has the greatest deviation from the calculated mean value is analyzed.This number is used in the following equation, together with the mean value [$\bar{x}$] and the standard deviation [s]:

$$PG = \frac{|x^* - \bar{x}|}{s}$$

The test variable [PG] is then compared with the corresponding value in the Grubbs table G (N, 90%), which in turn depends on the number of measured values N:

N (number of samples)	1	2	3	4	5	6	7	8	9	10
90 %	-	-	1.15	1.46	1.67	1.82	1.94	2.03	2.11	2.18
N (number of samples)	11	12	13	14	15	16	17	18	19	20
90 %	2.23	2.29	2.33	2.37	2.41	2.44	2.48	2.5	2.53	2.56
N (number of samples)	21	22	23	24	25	26	27	28	29	30
90 %	2.58	2.6	2.61	2.63	2.65	2.67	2.69	2.7	2.72	2.74
N (number of samples)	31	32	33	34	35	36	37	38	39	40
90 %	2.75	2.77	2.78	2.79	2.81	2.82	2.83	2.84	2.86	2.87
N (number of samples)	41	42	43	44	45	46	47	48	49	50
90 %	2.88	2.89	2.9	2.91	2.92	2.92	2.93	2.94	2.95	2.96
N (number of samples)	51	52	53	54	55	56	57	58	59	60
90 %	2.97	2.97	2.98	2.99	3	3	3.01	3.02	3.02	3.03
N (number of samples)	61	62	63	64	65	66	67	68	69	70
90 %	3.03	3.04	3.04	3.05	3.05	3.06	3.06	3.07	3.07	3.08
N (number of samples)	71	72	73	74	75	76	77	78	79	80
90 %	3.08	3.08	3.09	3.09	3.1	3.1	3.11	3.11	3.12	3.12
N (number of samples)	81	82	83	84	85	86	87	88	89	90
90 %	3.12	3.13	3.13	3.14	3.14	3.15	3.15	3.16	3.16	3.17
N (number of samples)	91	92	93	94	95	96	97	98	99	100
90 %	3.17	3.17	3.18	3.18	3.19	3.19	3.2	3.2	3.21	3.21
N (number of samples)	101	102	103	104	105	106	107	108	109	110
90 %	3.21	3.22	3.22	3.22	3.23	3.23	3.23	3.23	3.24	3.24
N (number of samples)	111	112	113	114	115	116	117	118	119	120
90 %	3.24	3.22	3.25	3.25	3.26	3.26	3.26	3.26	3.27	3.27

If the calculated test variable PG is greater than the corresponding value taken from the table, the measured value x* is identified as an outlier and marked accordingly.
After an outlier has been identified, the test is repeated with the remaining measured values (without the already identified outlier) using the newly calculated mean value and new standard deviation. This process is repeated continually until no further outlier can be identified.
It is then the user's responsibility to exclude any identified outliers from the statistics. After confirmation, the entire sample is excluded and the statistics are recalculated without the identified and excluded outliers.

9 Setup

This section tells you how to set up the titrator in accordance with your requirements so that you can carry out titration.

Chemicals	**Titrants**
	Auxiliary reagents
	Calibration standards
	Concentration and titer standards
	Substances
Hardware	**Sensors**
	Pumps
	Peripherals
	Titration Stands
	Auxiliary Instruments
User settings	**Language**
	Screen
	Audio signal
	Shortcuts
	Keyboard
Global settings	**System**
	User management
	Analysis and resources behavior
Values	**Blank**
	Auxiliary values
Mainten. & Service	**MT-Service**
	Import / Export
	Reset to factory settings
	Titrator firmware history
	Board firmware
	Terminal
	Board data
	Drives
	Burettes
	Update

9.1 Chemicals

Navigation: **Home** > **Setup** > **Chemicals**

In Chemicals, configure and manage the titrant, auxiliary reagents, titer standard, and other substances. You can view and print out lists of chemicals that have already been defined. You can also specify new chemicals or delete created chemicals. Auxiliary reagents must be assigned to a pump with which they can be added.

Settings	Explanation
Titrants	Titrants are managed together with burettes and burette drive.
Auxiliary reagent	Auxiliary reagents are liquid chemicals that can be used to aid the titration process.
Calibration standards	Calibration standards are used for the calibration of sensors.

Settings	Explanation
Titer standards	The titer standards required to determine the titer for the titrant used can be stored and managed.
Substances	Any chemical substances that are required for performing your analyses can be managed using name, empirical formula, molecular weight, and equivalent number.

9.1.1 Titrants

Navigation: **Home** > **Setup** > **Chemicals** > **Titrants**

Titrants are managed together with burettes and burette drive (PnP with chip and traditional burettes without chips).
For classical burettes, the relevant titrant data is entered manually. For PnP (Plug&Play) burettes, the data is automatically read from the chip and automatically transferred to the instrument. If the chip is still blank, the data must be entered in **Setup** or assigned to a titrant. The data is saved in both the titrator and in the chip.

Add a titrant

1 In **Titrants** choose **New**.
2 Check the parameter settings and if needed, adjust them.
3 Tap **Save**.

Parameters	Description	Values
Type	The type of titrant. You can select from the following types of titrant. **General titration**: for general titration (GT). **Auxiliary reagent**: if you are adding reagents manually using a burette.	General titration I Auxiliary reagent
Name	Specify a descriptive name of your choice.	Arbitrary
Concentration	The nominal concentration of the titrant, in [mol/L]. For **Type** = **General titration**.	0.00001…100
	The non-dimensional concentration of an auxiliary reagent. For Type = Auxiliary reagent.	0.00001…10^4
Titer	The titer for the titrant. For **Type** = **General titration**	0.00001…10
Shelf life	Defines the expiration date of the chemical as given by the supplier.	Date
Lot/Batch	The lot or batch of the reagent. Enter any designation.	Arbitrary
Fill rate	The filling rate of the burette in percent. 100% stands for maximum filling rate.	30…100
Burette volume	Select the burette volume in [mL].	1 I 5 I 10 I 20
Drive	Defines the drive on which you will use the burette containing the titrant.	List of available drives
Serial number	The serial number of the relevant device type.	Arbitrary

Note

- Titrants (independently of the type) must each be assigned to a drive.
- A maximum of 100 titrants can be defined in the instrument.
- In PnP burettes, the serial number is entered automatically. This can, however, be changed.

9.1.2 Auxiliary reagents

Navigation: **Home** > **Setup** > **Chemicals** > **Auxiliary reagents**

Auxiliary reagents are liquid chemicals that can be used to aid the titration process. Auxiliary reagents must be added using a pump and can be used via the method functions **Pumps** and **Rinse**.

Adding an auxiliary reagent

– In **Auxiliary reagents** choose [**New**].

⇨ The windows to edit the parameters opens.

Define the following parameters for each auxiliary reagent here:

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Pump	Use this setting to select a pump.	List of available pumps

Note

- Auxiliary reagents must be assigned to a pump with which they can be added.
- A maximum of 50 auxiliary reagents can be defined in the instrument.

9.1.3 Calibration standards

Navigation: **Home** > **Setup** > **Chemicals** > **Calibration standards**

Calibration standards are used for the calibration of sensors. The instrument contains various calibration standard lists for the calibration of pH sensors (pH buffer lists), ISE sensors (ISE standard lists) and conductivity sensors (conductivity standard lists) (see Appendix). In this dialog, you can view and print the predefined lists stored in the titrator, and create additional user-defined calibration standard lists for pH buffers and ISE and conductivity standards.

Adding a user-defined calibration standard lists

1 In **Calibration standards**, choose [**New**].

⇨ The windows to edit the parameters opens.

2 Edit the parameters and save the settings.

⇨ After you have created a calibration standard list, you can add various buffers and standards to this list, depending on the type selected.

Parameters	Description	Values
Type	Select the corresponding type for the new calibration standard list.	pH I Auto pH I ISE I Conductivity
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used will depend on the type selected.	pH I pM I pX I ppm I mS/cm I µS/cm
Base list	Add the calibration standard lists of various pH buffers by selecting them from the list. Only for **Type** = **Auto pH**.	List of available calibration standards
Ref. temperature	Define the reference temperature of the buffer.	-20…200

Note

- To delete a user-defined calibration standard list from the titrator, you must first access the parameters in the list via [**Info**]. From this dialog, you can delete the calibration standard list from the titrator memory by selecting [**Delete**].
- A maximum of 20 user-defined calibration standard lists and 10 auto pH buffer lists can be defined in the titrator.

Adding a pH Calibration Standard (pH Buffer)

- After creating a calibration standard list of the type **pH**, add various pH buffers to it.

1 Add various pH buffers by choosing [**New**].

2 Enter the respective pH value of the buffer, based on the reference temperature from the calibration standard list and tap [**OK**].

⇨ To reflect the temperature influence of a pH buffer, enter a maximum of 20 value pairs for each individual buffer composed of the temperature and corresponding pH value.

3 Choose a buffer and add various values by choosing [**New**].

4 Enter the respective pH value of the buffer, based on the reference temperature from the calibration standard list.

5 Save the list by tapping [**Save**].

Adding a pH Calibration Standard (pH buffer) of type Auto pH

- For a calibration standard list of the type **Auto pH**, the various pH buffers are detected by the titrator automatically. In order to ensure positive identification, the pH values of the individual solutions must differ from each other by at least two units.

1 Add various pH buffers to the calibration standard list by choosing [**Add**] and selecting them from the specified list.

2 Save the list by tapping [**Save**].

⇨ By doing so, the titrator offers only suitable pH buffers in order to ensure that the selected pH buffers always differ from each other by at least two pH points.

Note

- The temperature dependency of the individual pH buffers is also taken from the base list and cannot be edited, only viewed.

Adding an ISE Calibration Standard (ISE Standard)

- After creating a calibration standard list of the type **ISE**, you can add various ISE standards to it.

1 Add various ISE standards to it by choosing [**New**].

2 Enter the corresponding value for the standard in the desired unit of measure, based on the reference temperature from the calibration standard list and tap [**OK**].

⇨ To reflect the temperature influence of an ISE standard, enter a maximum of 20 value pairs for each individual standard composed of the temperature and corresponding standard value.

3 Choose a buffer and add various values by choosing [**New**].

4 Save the list by tapping [**Save**].

Adding a Conductivity Calibration Standard (Conductivity Standard)

- After creating a calibration standard list of the type **Conductivity**, add various conductivity standards to it.

1 Add various conductivity standards to it by choosing [**New**].

2 Enter the conductivity for each standard based on the reference temperature from the calibration standard list and tap [**OK**].

⇨ To reflect the temperature influence of a conductivity standard, enter a maximum of 20 value pairs for each individual standard composed of the temperature and corresponding conductivity value.

3 Choose a buffer and add various values by choosing [**New**].

4 Save the list by tapping [**Save**].

9.1.4 Titer standards

Navigation: **Home** > **Setup** > **Chemicals** > **Titer standards**

The titer standards required to determine the titer for the titrant used can be stored and managed in the titrator.

Add a standard

1 In **Titer standards**, choose **New**.

2 Check the parameter settings and if needed, adjust them.

3 Tap **Save**.

Parameters	Description	Values
Type	Defines whether it is a liquid or solid titer standard.	solid I liquid
Name	Specify a descriptive name of your choice.	Arbitrary
Purity	The purity of a solid standard, in percent. Only for **Type** = **solid**.	0.001…100.000
Concentration	The concentration of a liquid standard, in [mol/L]. Only for **Type** = **liquid**.	0.00001…100
M	The molar mass of a solid standard, in [g/mol].	10^{-5}…10^{3}

Equivalent number	The equivalent number "z" of the standard	1…9
Density	The density of a liquid standard, in [g/ml]. (Type = **liquid**)	10^{-4}…100
Lot/Batch	The lot or batch of the reagent. Enter any designation.	Arbitrary
Container ID	Defines the ID of the container that contains the chemical.	1…30 characters
Article number	Defines the article number of the chemical.	1…30 characters
Supplier	Defines the name of the company that supplied the chemical.	1…30 characters
Shelf life	Defines the expiration date of the chemical as given by the supplier.	Date

Note

- All fields except for **Lot/Batch** must be filled before the standard can be saved.
- A maximum of 50 titer standards can be defined in the instrument.

9.1.5 Substances

Navigation: **Home** > **Setup** > **Chemicals** > **Substances**

Any chemical substances that are required for performing your analyses can be managed using name, empirical formula, molecular weight, and equivalent number.

Adding a substance

– In **Substances** choose [**New**].

⇨ The windows to edit the parameters opens.

Define the following parameters:

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Empirical formula	Defines the empirical formula of the substance.	Arbitrary
Molecular weight	Defines the molecular weight of the substance.	0.0001…10^4
Equivalent number	The equivalent number "z" of the standard	1…9

Note

- A maximum of 100 substances can be defined.

9.2 Hardware

In **Hardware**, configure all the hardware components connected to the titrator.

Navigation: **Home** > **Setup** > **Hardware**

Settings	Description
Sensors	Configure and manage sensors to be used with the titrator.
Pumps	Configure a maximum of 20 pumps for use with the titrator.
Peripherals	Peripherals encompasses all input and output devices that belong to the titrator environment.
Titration Stands	Configure the titration stands connected to the titrator.
Auxiliary Instruments	Auxiliary instruments can be any instruments that access a titrator's TTL or 24 V output, stirrer or RS-232 connection and that are to be used in a method.

9.2.1 Sensors

Navigation: **Home** > **Setup** > **Hardware** > **Sensors**

You can configure and manage sensors to be used with the titrator as well as change settings already stored in the titrator. The settings for an individual sensor can also be output to a printer. In addition, the corresponding method for sensor calibration can be accessed from here.

Note

- A maximum of 50 sensors can be defined in the device.
- Each sensor is associated with a specific type. Each sensor type can deliver measured values in one or more units of measure. The following table provides information regarding which units of measure can be selected for a corresponding sensor type:

Sensor type	Default unit of measure	Eligible units of measure
mV	mV	mV
pH	pH	pH I mV
ISE	pM	pM / pX I ppm I mV
Phototrode	%T	%T I A I mV
Polarized	mV	mV I µA
Temperature	°C	°C I K I °F

[1)]Plug and Play sensors (PnP) are available for pH or mV measurements.

- Changing the unit of measurement for a sensor may render the calibration parameters and expiration date parameters meaningless and result in their subsequent omission. This may also mean that the calibration parameters are recalculated by the titrator (for temperature sensors), or that another set of calibration parameters is displayed (for ISE sensors).

Adding a sensor

– In **Sensors** choose [**New**].

⇨ The windows to edit the parameters opens.

Plug and Play sensors (PnP)

- If a PnP sensor is connected to the sensor input, this automatically generates an entry in the setup. All information (sensor name, type or inputs) is updated by the titrator (if a PnP sensor is not connected, the entry "PnP" appears for the sensor input).
- The setup may contain several PnP sensors with identical sensor IDs but with different sensor input information. When the analysis starts, a validation is carried out during which the user is prompted to remove a sensor. For several PnP sensors with the same ID, all entries apart from one are deleted when the sensors are removed.

The following settings are available for configuring a sensor depending on the sensor type selected:

Sensor type: mV

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	Defines the unit of measure that is used for the measurement.	mV
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary

Sensor type: pH

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	pH
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary
Calibration	Determines the calibration type. Displayed if **Unit** is set to **pH**.	Linear I Segmented
Zero point	The pH value where the sensor reads 0.0 mV.	-100…100
Slope (TCalib)	The slope of the sensor at the calibration temperature in [mV/pH].	-100…100
Slope (25.0°C)	Defines the slope of the sensor at 25.0 °C in [mV/pH]. The slope is calculated based on the value of **Slope (TCalib)** and **Calib. temperature**.	-100…100

Slope	Defines the slope of the sensor in [%].	-200.0…200.0
Number of segments	Defines the number of segments for a segmented calibration.	2…8
Zero point 1…8	Defines the zero point for the specified segment.	-100.0…100.0
Slope (TCalib) 1…8	Defines the slope of the segment at the calibration temperature in [mV/pH].	-100…100
Slope (25.0°C) 1…8	The slope of the segment at 25.0 C in [mV/pH]. The slope is calculated based on the segment's value of **Slope (TCalib)** and **Calib. temperature**.	-100…100
Slope 1…8	Defines the slope of the segment in [%].	-200.0…200.0
Seg. limit 1,2… 7,8	Defines the boundary between the two segments in [pH].	-100.0…100.0
Internal temperature sensor	Select this option if the sensor has an internal temperature sensor. In this case the system will automatically make an entry in the sensor setup for the internal temperature sensor.	Activ I Inactive
Calib. temperature	Defines the temperature at which the calibration was performed.	-20…200
Calibration method	Shows the method of the last change to the calibration values. **Manual**: The calibration values were entered or changed manually in the sensor setup. **Name of calibration method**: The calibration values were change by a calibration method.	Manual I Name of calibration method
Date / Time	Shows date and time of the last change to the calibration values, regardless of whether the values are changed manually, automatically, or with the calibration method.	
Performed by	Shows which user was logged in when the calibration value was determined or changed.	User name

Note

- The parameters zero point, slope and the corresponding calibration temperature are required to convert the mV signal of the sensor to the selected unit. These appear only for the unit [pH].

Sensor type: Phototrode

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I %T I A
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary
Wavelength	The Phototrode DP5 features a selection of 5 fixed wavelengths in [nm].	520 I 555 I 590 I 620 I 660
Zero point	The percentage of transmittance where the sensor reads 0.0 mV.	-100 … 100
Slope	The slope of the phototrode in [mV/%T].	-100…100
Calib. temperature	Defines the temperature at which the calibration was performed.	-20…200
Calibration method	Shows the method of the last change to the calibration values. **Manual**: The calibration values were entered or changed manually in the sensor setup.	Manual
Date / Time	Shows date and time of the last change to the calibration values, regardless of whether the values are changed manually, automatically, or with the calibration method.	
Performed by	Shows which user was logged in when the calibration value was determined or changed.	User name

Note

- The parameter **Calib. temperature** cannot be edited for segmented calibration; in this case, the system displays an information field.

Sensor type: Polarized

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I µA
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary

Sensor type: Temperature

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	°C I K I °F
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary
Zero point	The adjusted point from the theoretical value for reading 0.0 °C.	-20 … 200 [°C] -4.0 … 392 [°F] 253.2 … 473.2 [K]
Calibration method	Shows the method of the last change to the calibration values. **Manual**: The calibration values were entered or changed manually in the sensor setup. **Name of calibration method**: The calibration values were change by a calibration method.	Manual I Name of calibration method
Date / Time	Shows date and time of the last change to the calibration values, regardless of whether the values are changed manually, automatically, or with the calibration method.	
Performed by	Shows which user was logged in when the calibration value was determined or changed.	User name

Sensor type: ISE

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	pM I pX I ppm
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary
Calibration	Determines the calibration type. Not displayed if **Unit** is set to **mV**.	Linear I Segmented
Zero point	The pM or pX value where the sensor reads 0.0 mV.	-100…100
Slope (TCalib)	The slope of the sensor at the calibration temperature in [mV/pX] or [mV/pM].	-100…100
Slope (25.0°C)	Defines the slope of the sensor at 25.0 °C in [mV/pX] or [mv/pM]. The slope is calculated based on the value of **Slope (TCalib)** and **Calib. temperature**.	-100…100
Number of segments	Defines the number of segments for a segmented calibration.	2…8
Zero point 1…8	Defines the zero point for the specified segment.	-100.0…100.0
Slope (TCalib) 1…8	Defines the slope of the segment at the calibration temperature in in [mV/pX] or [mv/pM].	-100…100

Slope (25.0°C) 1…8	The slope of the segment at 25.0 C in in [mV/pX] or [mv/pM]. The slope is calculated based on the segment's value of **Slope (TCalib)** and **Calib. temperature**.	-100…100
Seg. limit 1,2… 7,8	Defines the boundary between the two segments in the selected unit.	For pM or pX: -100.0…100.0 For ppm: 0… 1,000,000
Calib. temperature	Defines the temperature at which the calibration was performed.	-20…200
Calibration method	Shows the method of the last change to the calibration values. **Manual**: The calibration values were entered or changed manually in the sensor setup. **Name of calibration method**: The calibration values were change by a calibration method.	Manual I Name of calibration method
Date / Time	Shows date and time of the last change to the calibration values, regardless of whether the values are changed manually, automatically, or with the calibration method.	
Performed by	Shows which user was logged in when the calibration value was determined or changed.	User name

Note

- For ISE sensors there are two independent calibration sets, one for the units "pM" or "pX" and one for the unit "ppm".
- When calibrating an ISE sensor in ppm units, the sensor's slope and zero point are specified in pX or pM units.

9.2.1.1 Value ranges from sensor measuring units and control band

Sensor type	Measuring unit	Value range	Value range EP relative	Value range Control band
mV sensor	mV	$-2*10^3…2*10^3$	$-4*10^3…4*10^3$	$0.1…4*10^3$
pH	pH	-100…100	-100.00…100.00	0.01…100
	mV	$-2*10^3…2*10^3$	$-4*10^3…4*10^3$	$0.1…4*10^3$
ISE	pM I pX	-100…100	-100.00…100.00	0.01…100
	ppm	$0…10^6$	$-10^7…10^7$	$0.001…10^7$
	mV	$-2*10^3…2*10^3$	$-4*10^3…4*10^3$	$0.1…4*10^3$
Phototrode	%T	0.001…100	$-1*10^3…1*10^3$	$0.1…1*10^3$
	A	0…5	$-10^6…10^6$	$0.01…10^6$
	mV	$-2*10^3…2*10^3$	$-4*10^3…4*10^3$	$0.1…4*10^3$
Polarized sensor	mV	$0…2*10^3$	$-2*10^3…2*10^3$	$0.1…2*10^3$
	µA	0…220	-220.0…220.0	0.1…220
Temperature	°C	-20…200	-220.0…220.0	0.1…220.0
	K	253.2…473.2	-220.0…220.0	0.1…220.0
	°F	-4…392	-396.0…396.0	0.1…396.0

9.2.1.2 Sensor Calibration and Sensor Test

Navigation: `Setup > Hardware > Sensors`

You can calibrate pH, ISE and temperature sensors or you can test your pH sensors.

Sensor calibration

pH, ISE, temperature and conductivity sensors can all be calibrated with the titrator. The phototrod can only be manually calibrated. To do this the relationship between sensor signal and transmission capacity must be determined and the calibration parameter to be determined (normally only the gradient from a single point calibration) must be entered "manually" in the selected phototrod.

If you want to calibrate a sensor with the titrator, you can either directly start an appropriate calibration method or specifically for pH sensors use [**Calibration/Sensor test**] in the sensor setup.

Temperature sensors are calibrated with the temperature standard "freezing water" (0°C). For conductivity sensors, you can choose the desired standard for the calibration from a standards list. Here a single point calibration is performed to determine the cell constant.

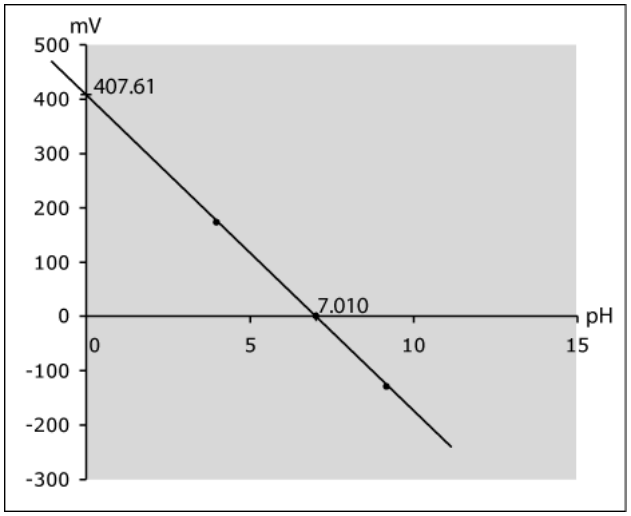
Two calibration modes are available for the calibrating pH and ISE sensors that can be selected under the "Probe (calibrate)" method function:

- linear calibration and segmented calibration (using the parameter "Calibration").

Both modes are briefly explained below.

Linear calibration

Linear calibration is explained below taking the example of pH sensor.



In linear calibration the 1st step is the capture of measurement data and the interpolation of the pH values with the buffer table to the effective values (the values used are only provided as an example):

	Selected buffer solutions	**During the calibration of the recorded temperature**	**mV values measured during calibration**	**pH (effective) by interpolation according to the pH buffer table**
1st Buffer	4.01 (at 25°C)	17 °C	172 mV	4.00
2nd Buffer	7.00 (at 25°C)	22 °C	0 mV	7.012
3rd Buffer	9.21 (at 25°C)	27 °C	-129 mV	9.19

In a second step, the mV measured values are converted to the averaged temperature "$T_{Average}$" (17°C+22°C +27°C) / 3 = 22°C):

	Selected buffer solutions	**mV values measured during calibration**	**Temperature-corrected measured values for TMean = 22°C**
1st Buffer	4.01 (at 25°C)	172 mV	174.96 mV
2nd Buffer	7.00 (at 25°C)	0 mV	0 mV
3rd Buffer	9.21 (at 25°C)	-129 mV	-126.85 mV

In the third stage, the gradient (T_{Mean}) and the mV value at pH 0 are determined by linear regression with the value pairs from mV (T_{Mean}) and pH (effective). The zero value is found from the mV value at pH 0, divided by the gradient (TMean):

- Slope (TMean) = -58.15
- mV value at pH 0 = 407.61 mV
- Zero point [pH]= mV value at 0 pH/Slope (TMean) = 7.010 [pH]

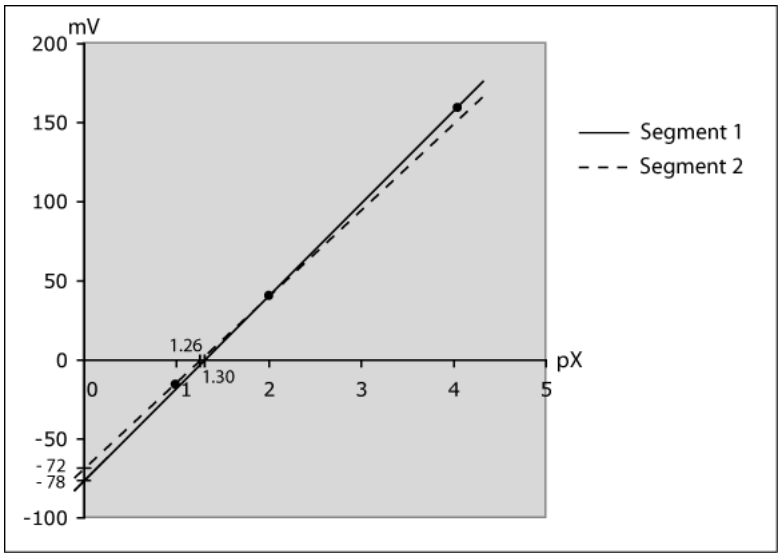
Lastly, the slope at (T_{Mean}) is back-calculated to the slope at (25°C).

- Slope (25°C) = -58.74 (=99.3% of the theoretical value)

Segmented calibration

With segmented calibration, no linear regression is performed across all measured points; instead, line segments that connect the individual calibration points are used. In this way allowance can be made for a non-linear performance of the sensor over a larger measurement range. For n standard solutions, (n-1) segments are evaluated.

The segmented calibration is explained below taking the example of an ISE sensor (F-).



Just as in the case of linear segmentation initially the readings are recorded:

	During the calibration of the recorded temperature	Standard value (pX) at measuring temperature	mV values measured during calibration
Standard 1	25 °C	4.00 (at 25°C)	162.0 mV
Standard 2	25 °C	2.00 (at 25°C)	42.0 mV
Standard 3	25 °C	9.21 (at 25°C)	-15.0 mV

The mV measured values are then converted to the averaged temperature (not necessary in the example because the temperature is constantly 25°C) and a linear regression is conducted for each segment. Thus for each segment a gradient and the mV value at pH 0 are determined (both related to the mean temperature) and from both values the zero point is respectively calculated:

	During the calibration of the recorded temperature	mV value at 0 pH (based on TMean)	Slope (TMean)	Zero point [pX]
Segment 1	25 °C	-78.00 mV	60.00	1.30
Segment 2	25 °C	-72.00 mV	57.00	1.26

Afterward, the slope is converted to the reference temperature of 25°C (not necessary in this example, because (T_{Mean}) is already 25°C.

9.2.2 Pumps

Navigation: **Home** > **Setup** > **Hardware** > **Pumps**

Solvent Managers

One Solvent Manager can be defined on a titrator. You cannot configure a Solvent Manager individually. Predefined settings are used when you connect a Solvent Manager to the back of the titrator or the sample changer.

Parameters	Description	Values
Type	Defines the type of pump.	Available pump types
Name	Specify a descriptive name of your choice.	Arbitrary
Pump output	The output where you want to operate the pump.	Available outputs

Peristaltic and membrane pumps

You can configure a maximum of 20 pumps for use with the titrator. Starting from the pump list, you can add new pumps or select existing ones and change their settings. The list can also be printed and pumps can be deleted.

You can set up different pumps. For each pump, you need to specify an explicit, user-defined name, the pumping rate and the connection from which the pump should operate.

Steps to add a pump:

– In **Pumps** choose [**New**].

⇨ The window to edit the parameters opens.

Parameters	Description	Values
Type	Defines the type of pump.	Available pump types
Name	Specify a descriptive name of your choice.	Arbitrary
Pump output	The output where you want to operate the pump.	Available outputs
Max. pump rate	Displays the pump rate in [mL/min] when the pump is operated at 100%. This is stated by the manufacturer or determined experimentally.	0.1…1000

9.2.3 Peripherals

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals**

These settings encompass all input and output devices that belong to the titrator environment but that are not essential instruments for processing an analysis (peripherals cannot be accessed in methods). The computer also counts as a peripheral device. The list of all peripheral instruments defined in the titrator, together with the parameters of each individual instrument can be printed out by a printer.

9.2.3.1 Balance

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Balance**

Before defining a balance, you need to select the balance type. The titrator supports the following types of balance:

Balance type	Supported balances
Mettler	AB I PB I PB-S I AB-S I PB-E I AB-E I College-S I SB I CB I GB I College-B I HB I AG I PG I PG-S I SG I HG I XP I XS I XA I XPE I XSE I XVE I AX I MX I UMX I PR I SR I HR I AT I MT I UMT I PM I AM I SM I CM I MS I ML
Sartorius	Sartorius
More	--

METTLER TOLEDO Balances

These balances support Plug'n'Play and are automatically recognized and configured by the titrator.

For automatic balance recognition, you need to ensure the following:

1. The balance has been started up and is connected to the titrator by a suitable cable,
2. The balance has been set to "Bidirectional" (if necessary, set the "Host" parameter accordingly),
3. The parameters for the RS-232 interface on the balance correspond with those on the titrator.

Note

- As long as the balance is not connected to the titrator, the settings "Baud Rate", "Data Bit", "Stop Bit", "Parity" and "Handshake" can be entered manually. These are however automatically overwritten with the values identified by the PnP as soon as the user sets the same transmission parameters at the balance and the titrator.

Sartorius I Others

After you have selected this option and the system has recognized the balance, you can define the following parameters:

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Serial number	The serial number of the relevant device type.	Arbitrary

Connection	The serial port to which the device is connected. Possible connections are located on the mainboard, the analog board and the conductivity board.	MB/COM1 I MB/COM2
Baud rate	The baud rate for data transmission via the RS-232 interface.	1200 I 2400 I 4800 I 9600 I 19200
Data bit	Defines the number of data bits.	7 I 8
Stop bit	Defines the number of stop bits. (2 stop bits can only be selected if 7 data bits are also selected at the same time.)	1 I 2
Parity	Defines the parity protocol.	Even I Odd I None
Handshake	Data transmission via the RS-232 interface. (Only the handshake option "Xon-Xoff" is available for serial connections on the analog and conductivity board in conjunction with a baud rate of 9600.)	None I Xon-Xoff

Note

- The settings for the baud rate, data bit, stop bit, parity, and handshake must agree for the balance and titrator!
- If **None** is selected as balance type that means that no balance is to be connected to the titrator.

9.2.3.2 USB-Stick

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **USB-Stick**

Commercially available USB sticks from USB Version 1.1 are supported.

You can assign a relevant name to the USB stick.

9.2.3.3 Printer and USB data export

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Printer**

The type of printer and data export via the USB interface is defined by **Printer type**.

Parameters	Description	Values
Printer type	Selection of a printer.	USB printer I USB compact printer I USB data export I PDF file writer I XML file writer

The available printers can be divided in 3 groups depending on the kind of output.

Printer	Paper	Files	XML stream
USB printer	•	-	-
USB compact printer	•	-	-
USB data export	-	-	•
Network printer	•	-	-
PDF file writer	-	•	-
XML file writer	-	•	-

Printing and data export can be triggered by the options listed below. Not all printers support all options.

- Method function **Record** inside or outside of loops
- **Print** button at the bottom of setup screens or result screens
- Specific settings in the method function **Calculation**, **Instruction**, **Titration (LearnEQP)**. Only supported by USB printer and Network printer.
- **Save results CSV** in **Setup** > **Global settings** > **Analysis and resources behavior** > **Analysis sequence settings**

Record

With the method function **Record** you can define which types of data are output. Not all printers support all types of data. For a detailed description of the parameters see chapter "Record".

MF Record inside of loop

Parameter	USB Printer / Network printer / PDF file writer	USB compact printer	USB data export / XML file writer
Summary	•	•	Export of predefined data (sample data, results and table of measures values) if set to **Per sample** or **Per series**.
Results	•	•	Settings are ignored.
Raw results	•	•	
Table of measured values	•	-	•
Sample data	•	•	Settings are ignored.
Resource data	•	•	
Charts	•	-	
Method	•	•	
Series data	•	•	

MF Record outside of loop

Parameter	USB Printer / Network printer / PDF file writer	USB compact printer	USB data export / XML file writer
Summary	•	•	Predefined data export if activated.
Results	•	•	Settings are ignored.
Raw results	•	•	
Resource data	•	•	
Calibration curve	•	-	
Method	•	•	
Series data	•	•	

Print button

The print button allows you to print out lists and parameter settings. In the menu **Results**, statistics can be printed in addition.

Printing with the print button is only supported by the printers listed below.

- USB printer
- USB compact printer
- Network printer
- PDF file writer

The parameters depend on the selected printer type and are described below.

USB printer, USB compact printer

The USB printer supports printers with PCL protocol version 4 and higher.

The USB compact printer does not support all languages.

Parameters	Description	Values
Status	Indicates whether the selected printer type is installed.	Installed
Name	Specify a descriptive name of your choice.	Arbitrary
Serial number	The serial number of the relevant device type.	Arbitrary
Connection	Information on the USB port to which the printer is connected. **PnP** is displayed if the printer is not connected to the titrator.	USB 1/2

USB data export

For USB data export to an RS interface you will need the USB data export box. If the USB data export box is connected to the titrator using the USB interface, it is automatically detected (PnP detection).

Parameters	Description	Values
USB data export box	Indicates whether the USB data export box is installed (info field).	Installed I Not installed
Connection	The USB port to which the USB data export box is connected (info field). **PnP** is displayed if the box is not connected to the titrator.	USB I PnP
Baud rate	The baud rate for data transmission via the USB interface.	1200 I 2400 I 4800 I 9600 I 19200
Data bit	Information on the number of data bits is displayed.	8
Stop bit	Information the number of stop bits is displayed.	1
Parity	Defines the parity protocol.	Even I Odd I None
Handshake	Data transmission via the USB interface.	None I Xon-Xoff

The max. Xoff duration for outgoing data is around 30 s.

Network printer

Printers with PCL protocol version 4 and higher are supported.

Parameters	Description	Values
Type	Defines the printing protocol used by the network printer.	HP PCL 3 I Epson ESC/P 2
Network name	Defines the network name of the connected printer.	-
Port number	Enter the specific port number for the connected printer.	-
Paper size	Defines the paper size for the printout of your data export.	A4 I Letter

PDF file writer

The data is written to a PDF file.

Parameters	Description	Values
Storage location	Defines where the file containing the exported data is stored. **USB-Stick**: Export to the connected USB-stick. **Ethernet**: Export to the shared folder defined in **Network storage**.	USB-Stick I Ethernet

XML file writer

The data is written to an XML file. XML files created with **XML file writer** cannot be imported in LabX.

Parameters	Description	Values
Storage location	Defines where the file containing the exported data is stored. **USB-Stick**: Export to the connected USB-stick. **Ethernet**: Export to the shared folder defined in **Network storage**.	USB-Stick I Ethernet

In the xml filed the method type is represented by a number in the tag <type></type>.

Method type	Number in xml file
Titration (EP)	52
Titration (EQP)	51
Titration (Learn EQP)	56
Titration (Therm.)	136

9.2.3.4 PC settings

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **PC settings**

PC settings is not available on the x10S titrators.

Configure these settings if you have your instrument connected to the PC software **LabX**.

Note

- The PC with LabX installed must always be connected to the PC (USB) or Ethernet port on the rear panel.

- After the settings have been modified, it may be necessary to restart the instrument.

Parameters	Description	Values
Connect to LabX at start-up	If this parameter is activated, a connection to LabX will be established on startup.	Activ I Inactive
Connection type	Defines how the titrator is connected to the PC, either via the network connection or via the USB connection.	Ethernet I USB
Status	Information on the connection status from the instrument to LabX.	Connected I Disconnected
Port number	Defines the port for a network connection of the titrator to LabX. Only appears for **Connection type** = **Ethernet**.	1024…65535

9.2.3.5 Network settings

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Network settings**

Configure these settings if you have your instrument connected to a network.

Parameters	Description	Values
Obtain IP address automatically	Indicates whether the IP address should be automatically obtained over the network.	Activ I Inactive
IP address	If the IP is not to be automatically obtained, you can enter it here.	000.000.000.000 … 255.255.255.255
Subnet mask	If you want to run the instrument on a local subnetwork, you can define the subnet mask here that you want to use to link the subnet's IP address.	000.000.000.000 … 255.255.255.255
Standard gateway	This is where you can enter the address of the standard gateway for communication between the various networks.	000.000.000.000 … 255.255.255.255

9.2.3.6 Network storage

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Network storage**

Configure these settings if you want to save data on a shared folder of a network drive. The instrument and the network drive have to be in the same subnet.

Parameters	Description	Values
Transfer via	Method for transferring data (only **Network share**).	-
Server	PC or server name. Users should have read-write access. Maximum 60 alphanumeric characters.	-
Share name	Name of the share which is defined for the shared folder.	-
User name	Type in the user name for accessing the shared folder. The user name must be defined in the setup for the shared folder.	-
Domain	Domain name of the server where the shared folder is located.	-
Password	Password for the network share.	-
Target folder	Defines the name of the **Target folder** where the data is saved. The **Target folder** is a subfolder in the shared folder.	-
First folder level	Defines if a subfolder is created in the folder defined in **Target folder** and how the subfolder is named. **None**: No subfolder is created. **User name**: A subfolder is created. The user name is used as name for the subfolder. **Titrator ID**: A subfolder is created. The titrator ID is used as name for the subfolder. **Date**: A subfolder is created. The date is used as name for the subfolder. **Method ID**: A subfolder is created. The method ID is used as name for the subfolder.	None I User name I Titrator ID I Date I Method ID

Second folder level	Defines if a subfolder is created in the folder defined in **First folder level** and how the subfolder is named. **None**: No subfolder is created. **User name**: A subfolder is created. The user name is used as name for the subfolder. **Titrator ID**: A subfolder is created. The titrator ID is used as name for the subfolder. **Date**: A subfolder is created. The date is used as name for the subfolder. **Method ID**: A subfolder is created. The method ID is used as name for the subfolder. Only if **First folder level** is activated.	None I User name I Titrator ID I Date I Method ID

9.2.4 Titration stands

Starting from the titration stand list, you can add new titration stands or select existing ones and modify their parameters. Furthermore the list can be printed out or individual titration stands can be deleted, whereby one of each type must be in the list.

The following types of titration stand can be connected:

- **Auto stand**
- **External stand**
- **Manual stand**
- **Rondolino TTL**

Add a titration stand

1 Go to **Home** > **Setup** > **Hardware** > **Titration Stands**

2 In **Titration Stands** tap **New**.

⇨ The window to edit the parameters opens.

3 In **Type** choose the type of titration stand to be added.

⇨ The parameters for the selected titration stand are displayed.

4 Edit the parameters according to the type of titration stand.

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands

9.2.4.1 Auto stand

If you use an auto stand, the popup window that reminds you to add the respective sample does not appear. Thus an interruption-free analysis sequence can be guaranteed for multiple determinations with an automation unit. The selected titration stand defines the stirrer output used in following method functions requiring a function **Stir**.

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs

9.2.4.2 Manual stand

The manual stand is typically used for the METTLER TOLEDO Manual Titration Stands. Before each sample in the series is analyzed, a popup window requesting confirmation that the respective sample is in place will appear. The selected titration stand defines the stirrer output used in following method functions requiring a function **Stir**.

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs

9.2.4.3 Rondolino TTL

The Rondolino sample changer can hold 9 samples to be tested in sequence. The Rondolino connects to the TTL port on the titrator. The selected titration stand defines the stirrer output used in following method functions requiring a function **Stir**.

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs
Connection	Indicates the connection type.	Available connections

9.2.5 Auxiliary instruments

Navigation: **Home** > **Setup** > **Hardware** > **Auxiliary instrument**

Auxiliary instruments can be any instruments that access a titrator's TTL or 24 V output, stirrer or RS-232 connection and that are to be used in a method (e.g. valves, dispensers).
An auxiliary instrument is switched on for a predefined period or switched on and then switched off again via the corresponding command. The instruments are controlled via the method function **Auxiliary instrument**.
Auxiliary instruments form part of a method, while peripherals are classified as input/output devices (printers, balances, barcode readers etc.), which do not have direct access to methods.

Starting from the auxiliary instrument list, you can add new auxiliary instruments or select existing ones or modify their parameters. Furthermore the list can be printed out at a printer or selected auxiliary instruments can be deleted.

Note

- A maximum of 50 auxiliary instruments can be saved in the titrator.

Adding an auxiliary instrument

1 In **Auxiliary instrument** choose [**New**].
   ⇨ The windows to edit the parameters opens.
2 In **Control type** you must first select the manner in which the auxiliary instrument is to be controlled.

⇨ After you have selected the relevant type, you can determine the parameters.

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Control type	The control type of the auxiliary instrument.	Output 24 V I Stirrer I Out TTL (Single pin) I Input TTL (Single pin) I RS-232

Output 24 V/Stirrer (0-18V output)

Parameters	Description	Values
Output	Information on the used output.	STIRRER I PUMP

TTL

Parameters	Description	Values
Output	Indicates which port and which pin on the titrator you want to use for the auxiliary instrument.	TTL-Out 1 I TTL-Out 2 I TTL-Out 3 I TTL-Out 4
Input	The input where the auxiliary instrument should be queried.	TTL-In 1 I TTL-In 2

RS-232

Parameters	Description	Values
Connection	Information on the serial port to which the device is connected.	COM
Baud rate	The baud rate for data transmission via the RS-232 interface.	1200 I 2400 I 4800 I 9600 I 19200
Data bit	Defines the number of data bits.	7 I 8
Stop bit	Defines the number of stop bits. (2 stop bits can only be selected if 7 data bits are also selected at the same time.)	1 I 2
Parity	Defines the parity protocol.	Even I Odd I None
Handshake	Data transfer via the RS-232 interface.	None I Xon-Xoff

9.3 User settings

Navigation: **Home** > **Setup** > **User settings**

These settings contains the options that can be made specifically for each currently logged in user.

You can configure the language, the screen settings (for the touchscreen), the layout of the alphanumeric and numeric keyboard, the use of beeps, and shortcuts for each user.

9.3.1 Language

Navigation: **Home** > **Setup** > **User settings** > **Language**

Define the following parameters:

Parameters	Description	Values
Touchscreen	Defines the language for operation of the terminal.	German I English I French I Italian I Spanish I Portuguese I Chinese I Russian I Polish I Korean
Record	Defines the language in which the reports are to be printed out.	German I English I French I Italian I Spanish I Portuguese I Chinese I Russian I Polish I Korean

Note

- For the Chinese and Korean language settings, it is not possible to print using the USB-P25 tape printer.
- For Polish, records can be printed on the USB-P25 tape printer without special characters.

9.3.2 Screen

Navigation: **Home** > **Setup** > **User settings** > **Screen**

Define the following parameters:

Parameters	Description	Values
Primary color	Here various color schemes for the user interface can be selected.	Gray I Blue I Green I Red
Brightness	Specifies the display brightness in [%].	50 I 60 I 70 I 80 I 90 I 100 [%]
Screen saver	Here you can define whether the screen saver should be used.	Activ I Inactive

Wait time	Defines how long in [min] the system should wait after the user's last action on the terminal before activating the screen saver.	1…1000

9.3.3 Audio signals

Navigation: **Home** > **Setup** > **User** > **Audio signal**

Define the following parameter:

Parameters	Description	Values
At push of a button	Enables a beep when tapping on the touch screen.	Activ I Inactive

9.3.4 Shortcuts

Navigation: **Home** > **Setup** > **User settings** > **Shortcuts**

The number of shortcuts depends on the titrator type.

Each user can manage the shortcuts that they have created. Individual shortcuts can be selected and deleted and the following parameters of a shortcut can be changed:

Parameters	Description	Values
Type	Shows the type of action the shortcut stands for.	Method I Series I Manual operation
Description	Any name for the shortcut.	Arbitrary
Immediate start	The method, series, or manual operation can be started immediately. This enables you to start the analysis without any interfering dialog.	Activ I Inactive
Homescreen position	Defines the position of the shortcut on the homescreen.	-
Created by	Shows the name of the user who created the shortcut.	-

9.3.5 Keyboards

Navigation: **Home** > **Setup** > **User settings** > **Keyboards**

In this dialog, you can define the layout for the alphanumeric and the numeric input fields. The following settings are available:

Parameters	Description	Values
ABC keyboard	Determines the layout of the alphanumeric input field.	English I French I German
123 keyboard	Defines the organization of the keys for the numeric input field.	Calculator I Phone

9.4 Global settings

Navigation: **Setup** > **Global settings**

In **Global settings**, you can make general settings on the titrator that apply for all users. The settings in this window can only be changed by users with the appropriate authorizations.

The settings include:

- **System settings** that apply for all users.
- **User management** for creating user accounts.
- The settings for **Analysis and resources behavior** determining the actions of the titrator before, during and after the performance of an analysis, and the response of the titrator when resources are deleted or when PnP resources are identified.

9.4.1 System

Navigation: **Home** > **Global settings** > **System**

Titrator identification

You can enter and assign any ID consisting of at least four characters to the titrator.

Parameters	Description	Values
Titrator ID	Define the instrument identification.	-
Titrator	Indicates the titrator type.	Titrator types
Serial number	Information on the serial number of the instrument.	-
Titrator FW version	Information on the firmware version of the instrument.	-

Date / Time

You can define the format used to display the date and time and set the titrator date and time.

Parameters	Description	Values
Date format	Defines the format for displaying the date.	mm/dd/yyyy I dd/mm/yyyy
Time format	Defines the format for displaying the time.	24h I a.m./p.m.
Date	Enter the current date.	-
Time	Enter the current time.	-

Header and footer

Define whether all printouts generated by the titrator should have a header or footer. The content of these headers and footers can be entered directly into the respective setting.

As part of the end of record, signature fields are appended to the respective printout consisting of a declaration (e.g. **Approved by**) followed by an empty line. A personal signature can be then be entered on this line.

Parameters	Description	Values
Header	Activates the header on print outs.	Activ I Inactive
Text	Defines the text for the header. Only for **Header** = **Active**.	Arbitrary
Footer	Activates the footer on print outs.	Activ I Inactive
Text	Defines the text for the footer. Only for **Footer** = **Active**.	Arbitrary
End of report	Select the information to be printed at the end of a report.	Created by I Modified by I Checked by I Approved by

Data storage

In this menu you can define if data is stored and if data is deleted when the instrument shuts down.

Parameters	Description	Values
Delete data on shut down	Define if analysis data is to be deleted from the titrator memory when the titrator is shut down.	Activ I Inactive
No storage of results	Results are not stored and cannot be viewed anymore after termination of a method.	Activ I Inactive

9.4.2 User Management

Navigation: **Home** > **Setup** > **Global settings** > **User management**

In the user management, you can add and delete users. A default user is already configured in the instrument. You can enter a maximum of 30 users.

1 In **User management** tap [**User**] to open the list of users.

2 To add a new user, tap [**New**].
- or -
Edit an existing user.

You can define the following parameters for each user account:

Parameters	Description	Values
User name	The user's login ID.	Arbitrary
Full name	The user's full name.	Arbitrary

User group	The user group to which the user is assigned.	Expert I Routine-User
Description	Any description for the user account or for the user.	Arbitrary
Created by	Shows the name of the administrator who created the user account.	-
Created on	Shows the date and time the user account was created.	-
Modified by	Shows the name of the administrator who modified the user account.	-
Modified on	Shows the date and time of the last change to the user account.	-

9.4.3 Analysis and resources behavior

The settings that you make here relate to the sequence of the analysis of samples or series with the aid of methods.

- You can define the actions of the titrator when started, during an analysis and afterward.
- You can also program the response of the titrator to the deletion of resources or when it identifies PnP resources.

Analysis sequence settings

The analysis sequence settings can only be modified if no tasks are currently being performed by the titrator.

You can make the following settings that influence the sequence of an analysis.

Parameters	Description	Values
Show required resources at start	When an analysis is started a screen appears displaying all resources required for the analysis and their status (available, not-available, locked or in use). If an individual entry is selected from this screen then the user receives additional information about the respective resource. However, if "no" is selected, then the required resources are still checked when the analysis is started and if necessary, an appropriate error message is issued.	Activ I Inactive
Show SOP	If an SOP (standard operating procedure) has been defined in the **Title** method function then this will be displayed before the method is started provided that **Active** has been selected.	Activ I Inactive
Show results after analysis	If a manual or external titration stand is being used, then the results for a sample are automatically displayed after they have been analyzed and must be acknowledged by the user before the analysis can be continued. With **Auto stand** the results are displayed for a certain period and are not to be confirmed. The activated parameter is valid for the following functions: **Analysis**: the results for a sample are shown **Calibration/Loop**: The results of the calibration are shown (slope, zero point) **Sensor test**: The results of the test are shown (slope, zero point, drift and sensor test OK / not OK)	Activ I Inactive
Check local printer connection and wait	When selected, the availability of a printer is checked at the beginning of the method. If not selected and no printer is connected, the method function **Record** is skipped. If a printer is connected, the method function **Record** is executed even if this parameter is not selected. Only for **USB printer**, **USB compact printer**.	Activ I Inactive

Save results CSV	Defines if some of the sample date and some of the results are saved to a CSV file. **No**: No data is saved. **To USB-Stick**: The CSV files are saved on the connected USB stick. If a USB-stick is not detected during the data writing, you can stop the process or you can plug in another USB stick for the data writing. **To network**: The CSV files are saved in the shared folder defined in **Network storage**. **Note** • A CSV file is exported for each sample when the method function **End of sample** is reached. There is no export outside of a loop. • The method function **Calculation** must be included inside the loop. • The export is in the record language. • When importing the CSV file into excel make sure, the data formats match.	To USB-Stick I To network I No
Check USB-Stick connection and wait	If this parameter is activated, the presence of a USB - Stick is validated at the start of the analysis. Only for **Save results CSV** = **To USB-Stick**.	Activ I Inactive

Resources behavior

Use the following parameters to configure how the titrator responds to the deletion of resources and its response to the automatic identification of PnP resources.

Parameters	Description	Values
Information when deleting resources	Defines if a confirmation will be requested before a resource is deleted.	Activ I Inactive
Information when recog-nizing PnP resources	Defines if a confirmation will be requested every time a PnP resource is identified.	Activ I Inactive

Pump and stirrer detection

Parameters	Description	Values
Stirrer detection	Defines if the automatic stirrer detection is activated. This may be necessary, for example, if you connect additional devices via the stirrer outputs that are not automatically identified by the titrator.	Activ I Inactive
Pump detection	Defines if the automatic pump detection is activated. This may be necessary, for example, if you connect additional devices via the pump outputs that are not automatically identified by the titrator.	Activ I Inactive

9.5 Values

Navigation: **Home** > **Setup** > **Values**

There are three blank values and three auxiliary values which can be used in formulas for calculations. These values cannot be deleted or renamed and no additional values can be created.

Blank values

A blank value, which is assigned to a solvent, can be transferred to methods by using the method function **Blank**.

1 In **Values**, select **Blank values**.

2 Tap the entry of a blank value to edit the corresponding parameters.

⇨ The windows to edit the parameters opens.

Parameters	Description	Values
Name	Shows the name of the value.	Blank 1…3
Unit	The units in which the blank is specified.	Arbitrary
Value	Here you can enter a numerical value.	-10^8…10^8
Determination method	Method name of the method used for the determination.	Method name
Date / Time	Date and time of the determination.	Date and time
Performed by	Name of the user performing the determination.	User name

Note

- When a blank is assigned with the method function **Blank**, this is updated in the settings immediately after completion of the method function.

Auxiliary values

The auxiliary value can be assigned to a result via the formula in the method function **Calculation**.

1 In **Values**, select **Auxiliary values**.

2 Tap the entry of an auxiliary value to edit the corresponding parameters.

⇨ The windows to edit the parameters opens.

Parameters	Description	Values
Name	Shows the name of the value.	Aux. val. 1…3
Comment	A brief comment (e.g. unit) to the auxiliary value can be entered .	Arbitrary
Value	Here you can enter a numerical value.	-10^8…10^8
Determination method	Method name of the method used for the determination.	Method name
Date / Time	Date and time of the determination.	Date and time
Performed by	Name of the user performing the determination.	User name

9.6 Maintenance & Service

Navigation: **Home** > **Setup** > **Mainten. & Service**

9.6.1 MT service

Navigation: **Home** > **Setup** > **Mainten. & Service** > **MT-Service**

In this dialog, you can view and print out a list of the most recent (max. 10) METTLER TOLEDO services. Under each date, the user name of the METTLER TOLEDO service technicians and the date and time of the service appointment are displayed. The most recently performed service always appears at the top of the list.

You can change the service life (in days) of the last service date and configure the titrator to issue a warning at a defined time before the service life elapses (requires administrator rights).

– In **MT-Service** tap [**Settings**].

⇨ The windows to edit the parameters opens.

Parameters	Description	Values
Initial operation	Defines the date of the initial operation of the titrator.	Date
Last service	Shows the date of the last service.	Date
Service life	Defines the service life (in days) from the most recently performed service.	0…10^4
Next service	Shows the due date of the next service.	Date
Reminder	Determines whether the titrator should issue a warning before the service life expires. Only if **Monitoring usable life** = **Active**.	Activ I Inactive

Days before expiration	Determines the number of days before expiry of the service life that the titrator should issue a warning. The value entered here must be smaller than the service life. (Appears only if "Reminder" is activated.)	0…1000

9.6.2 Import/Export

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Import / Export**

You can use this function to save titrator data on a USB stick (export) and reload the data back to a titrator later on (import).

Thus is it possible to create a backup of most data that has been changed from the titrator's default settings.

Uploading data from a backup copy results in the existing data in the titrator being overwritten. In this way you can immediately duplicate the status of one titrator in another one or restore titrator settings after repair.

The following two rules should be observed:

- Memory copies can only be imported from the same titrator type.
- Memory copies, user management and methods can only be imported from the same or from a lower firmware version.

You can select whether you want to export or import a backup copy, an individual method, all methods or the user management.

A memory copy includes the information listed below.

- All parameters of methods and series
- Setup including all resources
- User settings
- Global settings (incl. user management)
- Settings for manual operations

A memory copy does **not** contain all saved results, data saved on a PnP component and the default parameters for manual operations.

Import/export of individual methods

When you import/export an individual method, you can select which method is to be exported or imported. You require the right to edit methods.

Import/export of all methods

When you export all methods, all methods are exported to individual XML files on the USB-stick.

When you Import all methods, all method related XML files on the USB-stick are checked and when a method is compatible with the titrator type, the method is imported. If not enough memory is free, a message is displayed. The user has to delete existing user or mettler methods on the titrator before he can import the methods. The user is asked whether an existing method should be overwritten if a method with the same method ID exists

Import/export of user management settings

When you import/export user management settings, the entire user management settings with all users and their properties are exported or imported.

1 Open **Setup** > **Mainten. & Service** > **Import / Export**.

2 Configure the following parameters:

Parameters	Description	Values
Action	Here you can select whether you wish to export the titrator data to a memory stick or to import it from a memory stick to a titrator.	Export I Import
Data	Defines which data is exported or imported. **Memory copy**: Exports or imports a backup copy. **Single method**: Exports or imports an individual method. **All methods**: Exports or imports all methods. **User management**: Exports or imports the user management.	Memory copy I Single method I All methods I User management
Method ID	Defines which method is imported or exported.	Method list

9.6.3 Reset to factory settings

NOTICE

Danger of data loss due to reset!

In the process of resetting the titrator all data and changes to settings made by users of the titrator are erased.

– Back up all data and settings.

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Reset to factory settings**

9.6.4 Titrator firmware history

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Titrator firmware history**

The **Titrator firmware history** button displays a list of the firmware updates or model upgrades. The first entry in the list represents the initial operation of the titrator.
All list entries are stored with date, type, FW version and the user name of the user who performed the action.

9.6.5 Board firmware

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Board firmware**

Display a list of all boards and burette drives available on the titrator along with the relevant firmware version. You can carry out an update.

9.6.6 Terminal

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Terminal**

Display the chip ID of the terminal and adjust the touchscreen.

If the alignment of the touch-sensitive areas of the screen correspond not exactly with the position of the buttons e.g. after a software update was performed, then you can solve this error by executing this function.

1 In **Terminal** tap [**Adjust touchscreen**].
   ⇨ The instrument will reboot and the adjustment screen appears.
2 Touch and hold a touch screen stylus (resistive) on the center of the target until it moves to the next position on the screen.
3 Repeat this procedure until a message appears.
4 Tap the screen to confirm or wait for 30 seconds for canceling (timeout).

⇨ The instrument will reboot.

Note

- Tap the center of the target as accurately as possible otherwise the process has to be repeated several times.
- Make sure not to touch any other locations on the screen and the fix key areas while doing this adjustment.
- Make sure not to touch the screen with your hand.
- Keep accurate angle for your usage.
- The adjustment process cannot be aborted.

9.6.7 Board data

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Board data**

Display and print out a list of all the boards fitted in the titrator. Each board is listed by name and module location.

If a board is selected from the list, then its chip ID and all data on available inputs and outputs including the adjustment data will be displayed.

9.6.8 Drives

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Drives**

Display and print a list of all connected drives. The list contains the position, serial number, chip-ID and status of each drive.

9.6.9 Burettes

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Burettes**

Display and print out a list of connected PnP burettes. Each PnP burette is listed with its chip ID, serial number, volume and position of the attached drive.

9.6.10 Update

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Update**

It is possible to update the firmware of your titrator. If you want to update the firmware of your titrator, contact your authorized METTLER TOLEDO dealer or service representative.

▶ www.mt.com/contact

10 Manual Operations

You can use manual operations to access various titrator functions that are not directly connected to the execution of an analysis, but that might be useful during the sample preparation, for example.
You can call up the following manual operations from here with the relevant titrator components:

Hardware components	Possible manual operations	Possible usages
Stirrer	**Stir**	Dissolve a solid sample
Sensor	**Measure**	Determine the pH or temperature of a solution
Burette	**Rinse**	Rinse burette before changing a titrant
	Rinse multiple burettes	Rinsing several burettes simultaneously
	Dispense	Dispense during sample preparation
	Manual titration	Manual titration using a color indicator
Pump	**Pump**	Pump auxiliary reagents in and out, fill and empty sample vessels, replace the solvent (for Karl Fischer water determination)
Auxiliary instrument	**Control**	Activating an external pump

Note

- It is not possible to perform parallel execution of multiple manual operations.
- The resource parameters in all editable fields can be changed temporarily (only for the execution of the manual operation in question) and can vary from the setup settings. The changes made will not be copied over to the setup, however.

10.1 Stirrer

To switch a connected stirrer on or off for a definable time interval and at a definable stirring speed, select the following:

Navigation: **Home** > **Manual** > **Stirrer**

1 Make a selection in **Titration stand**.
2 Enter the stir time in [sec] or select "∞" for an infinite duration.
3 Tap [**Start**] to start the stirrer.

⇨ The stirrer starts. Tap [**Stop**] to stop the stirrer at any time (terminating the manual operation).

Define the following parameters:

Parameters	Description	Values
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Information on the used stirrer output.	STIRRER
Speed	Defines the stirring speed in [%].	0…100
Stir time	The stirring time, in [sec], during which the stirrer should be in operation. Select "∞" for unlimited stirring time.	$0…10^4$ I ∞

Note

- Entries made here will only be applied to the manual operation and will have no effect on the instrument settings.

10.2 Pump

Within Pump, the following actions are available.

- **Pump**
- **Drain**
- **Fill**

Parameters	Description	Values
Action	Determines the actions for the pump process.	Fill I Pump I Drain

For **Drain** and **Fill** you can activate and configure a stirrer.

The parameters available for each action and stirrers are described in the following chapter.

10.2.1 Pump

This manual operation will use a connected pump to pump in any volume of auxiliary reagent or - depending on the connection of the tubes - to drain it from the titration vessel.

Proceed as follows to start a pump process:

1 Go to **Home** > **Manual** > **Pump**.

2 Set **Action** to **Pump**

3 Select the pump and adjust the pump rate.

4 Enter the volume in [mL] to be added.

5 Tap **Start** to start the procedure.

⇨ The procedure starts. Tap **Stop** to stop the procedure at any time.

You can determine the following parameters:

Parameters	Description	Values
Auxiliary reagent	The auxiliary reagent to be added.	List of available auxiliary reagents
Pump	Use this setting to select a pump.	List of available pumps
Max. pump rate	Displays the pump rate in as defined in the settings. Changing this value does not change the rate of the pump, only the time calculated for the addition.	0.1…1000 mL/min
Pump output	The output where you want to operate the pump.	Available outputs
Volume	The volume to be dispensed, in [mL]. Select "∞" for unlimited pumping.	0…1000 I ∞

10.2.2 Drain

Parameters	Description	Values
Drain pump	Defines, which pump is used for draining.	Available pumps
Pump output	The output where you want to operate the pump.	Available outputs
Drain duration	Defines the pumping time for draining a fluid. The duration of the drain operation for the tubes should be as long as possible to ensure that the tubes are completely free of liquids following draining.	0…1000 s I ∞
Max. pump rate	Displays the pump rate in as defined in the settings. Changing this value does not change the rate of the pump, only the time calculated for the addition.	0.1…1000 mL/min

See also

Stirrer ▸ Page 106

10.2.3 Fill

Parameters	Description	Values
Fill pump	Defines, which pump is used for filling.	Available pumps
Pump output	The output where you want to operate the pump.	Available outputs
Fill time	Defines the pumping time for filling a titration vessel.	0…1000 s I ∞
Max. pump rate	Displays the pump rate in as defined in the settings. Changing this value does not change the rate of the pump, only the time calculated for the addition.	0.1…1000 mL/min

See also

Stirrer ▸ Page 106

10.2.4 Stirrer

Parameters	Description	Values
Stirrer	A stirrer can be switched on. Only for **Action** = **Fill** or **Drain**.	Activ I Inactive
Titration stand	The name of the titration stand. only if stirrer is activated.	List of titration stands
Stirrer output	Defines the stirrer output.	Available stirrer outputs
Speed	Speed in [%]. Only if stirrer is activated.	0…100

10.3 Sensor

To take a measurement using any connected sensor, select the following:

Navigation: **Home** > **Manual** > **Sensor**

1 Make a selection in **Sensor**.

2 Select the desired stirrer and enter a speed.

3 For polarized, potentiometric and conductivity sensors, specify whether the temperature should be entered manually or automatically.

4 For manual temperature acquisition, enter the temperature.
- or -
For automatic temperature acquisition, select a connected temperature sensor and the temperature unit to be used.

5 Enter the duration of the measurement in [sec] or select "∞" for an infinite duration.

6 Select whether to output a record on the printer.

7 To output a record on the printer, use dt [sec] to define the time interval between measurements.

8 Tap **Start** to start the measurement.

⇨ The measurement starts. Tap **Stop** to stop the measurment at any time (terminating the manual operation).

⇨ During the measurement, the system will display the online curve (measured values in the selected unit versus time). Use **Measured values** to display a table of measured values instead of the curve.

10.3.1 Temperature sensor

You can define the following parameters for a manual operation:

Parameters	Description	Values
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Sensor input	Information on the used input.	PT1000
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	°C I K I °F
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Information on the used stirrer output.	STIRRER
Speed	Defines the stirring speed in [%].	0…100
Duration	The measurement and stirring time, in [sec]. Select "∞" for unlimited measurement time.	$0…10^4$ I ∞
Record	If activated, the measured values will be printed out.	Activ I Inactive
dt	Defines the time interval in [sec] for outputting measured values to the printer. Only appears if **Record** = **Active** was selected.	1…6000

Note

- Entries made here will only be applied to the manual operation and will have no effect on the instrument settings.

10.3.2 Potentiometric Sensor

Potentiometric sensors are potentiometric indicator electrode, such as glass electrodes for pH measurement, Redox electrode for measuring the redox potential or ion-selective electrodes (ISE) for determining of ion content in the solution. Below, the editable parameters are listed for both potentiometric sensors and photrodes used for turbidimetric and color induced titrations:

Parameters	Description	Values
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I pH I pM I A I %T
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Information on the used stirrer output.	STIRRER
Speed	Defines the stirring speed in [%].	0…100
Temperature manual	Defines whether to enter the temperature manually (**Active**) or via a temperature sensor (**Inactive**).	Activ I Inactive
Temperature	If the temperature is entered manually, you can enter it here, in [°C]. Only appears if **Temperature manual** = **Active** was selected.	-20…200
Temperature sensor	Here you can select the required temperature sensor. Only appears if **Temperature manual** = **Inactive** is selected.	List of available sensors
Sensor input	Information on the used input.	PT1000
Temperature unit	The unit of measure for the temperature measurement. Only appears if **Temperature manual** = **Inactive** was selected.	°C I K I °F
Duration	The measurement and stirring time, in [sec]. Select "∞" for unlimited measurement time.	0…10^4 I ∞
Record	If activated, the measured values will be printed out.	Activ I Inactive
dt	Defines the time interval in [sec] for outputting measured values to the printer. Only appears if **Record** = **Active** was selected.	1…6000

Note

- The parameters for temperature acquisition or entering the temperature, **Temperature manual**, **Temperature**, **Temperature sensor**, **Sensor input** and **Temperature unit** are omitted for mV sensors and the phototrode.
- Entries made here will only be applied to the manual operation and will have no effect on the instrument settings.

10.3.3 Polarized sensor

You can define the following parameters for a manual operation:

Parameters	Description	Values
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Sensor input	Information on the used input.	SENSOR
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Amperometric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA

Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Information on the used stirrer output.	STIRRER
Speed	Defines the stirring speed in [%].	0…100
Temperature manual	Defines whether to enter the temperature manually (**Active**) or via a temperature sensor (**Inactive**).	Activ I Inactive
Temperature	If the temperature is entered manually, you can enter it here, in [°C]. Only appears if **Temperature manual** = **Active** was selected.	-20…200
Temperature sensor	Here you can select the required temperature sensor. Only appears if **Temperature manual** = **Inactive** is selected.	List of available sensors
Sensor input	Information on the used input.	PT1000
Temperature unit	The unit of measure for the temperature measurement. Only appears if **Temperature manual** = **Inactive** was selected.	°C I K I °F
Duration	The measurement and stirring time, in [sec]. Select "∞" for unlimited measurement time.	0…10^4 I ∞
Record	If activated, the measured values will be printed out.	Activ I Inactive
dt	Defines the time interval in [sec] for outputting measured values to the printer. Only appears if **Record** = **Active** was selected.	1…6000

Note

- Entries made here will only be applied to the manual operation and will have no effect on the instrument settings.

10.4 Auxiliary Instrument

Navigation: **Home** > **Manual** > **Auxiliary instrument**

Selectively control here the titrator's inputs and outputs. You can transmit outgoing signals and query incoming signals. This lets you check whether the communication is functioning between the titrator and a connected auxiliary instrument. In this way, manually triggered auxiliary instrument functions can be used as support for a titration.

To activate an auxiliary instrument, proceed as follows:

1 In **Control type**, select the auxiliary instrument to be controlled.

2 Enter the specific communication parameters for the control type.

3 Tap [**Start**] to start the procedure.

⇨ The procedure starts. Tap [**Stop**] to stop the procedure at any time.

The following parameters are available, depending on the type:

Parameters	Description	Values
Control type	The control type of the auxiliary instrument.	Output 24 V I Stirrer I Out TTL (Single pin) I Input TTL (Single pin) I RS-232

For Control type = Output 24 V, the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Output	Information on the used output.	PUMP
Duration	The time, in [sec], the auxiliary instrument should be switched on. Select "∞" for unlimited time.	0…10^4 I ∞

Note

- An auxiliary instrument controlled by the control type **Output 24 V** can be switched on and off or operated for a defined period of time.

For Control type = TTL , the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Output	Indicates which port and which pin on the titrator you want to use for the auxiliary instrument.	TTL-Out 1 I TTL-Out 2 I TTL-Out 3 I TTL-Out 4
Mode	Determines the number and type of TTL signal issued. **Fixed time**: The control output is switched on for the defined time period. **Input controlled**: A signal received at the control inlet controls the control outlet. The Auxiliary Instrument function will be terminated as soon as the signal changes at the control inlet or after a defined maximum time has expired. **Sequential**: The control output runs through a defined sequence.	Fixed time I Input controlled I Sequential
Duration	The time, in [sec], the auxiliary instrument should be switched on. Select "∞" for unlimited time.	$0…10^4$ I ∞
Input aux. instr.	The name of the auxiliary instrument to serve as the signal input (control input). Only appears for **Mode** = **Input controlled**.	List of auxiliary instrument
Input	The input where the auxiliary instrument should be queried.	TTL-In 1 I TTL-In 2
Input signal	Indicates whether an rising or a falling input signal should be detected.	Rising I Falling
Max. wait time	The maximum waiting time for a signal change. After it expires, the method will be continued even if no input sequence was detected. Only appears for **Mode** = **Input controlled**.	$0…10^4$ I ∞
Output signal	**Normal**: The signal is transmitted without conversion. **Inverted**: The signal is transmitted in inverted form. Only if **Mode** = **Input controlled**.	Normal I Inverted
Number of pulses	The number of impulses in the planned sequence. Only if **Mode** = **Sequential**.	$0…10^4$
Pulse duration	The duration of a pulse, in [sec]. Only appears for **Mode** = **Sequential**.	$0…10^4$
Interval	Defines the time span, in [sec], between two impulse starts. Only if **Mode** = **Sequential**.	$0…10^6$ I $0…10^4$

- If **Mode** = **Input controlled** was selected, the system checks the incoming input signal until the maximum time expires or a signal is received.

For Control type = Input TTL (Single pin), the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Input	The input where the auxiliary instrument should be queried.	TTL-In 1 I TTL-In 2
Input signal	Indicates whether an rising or a falling input signal should be detected.	Rising I Falling
Max. wait time	The maximum waiting time for a signal change. After it expires, the method will be continued even if no input sequence was detected. Only appears for **Mode** = **Input controlled**.	$0…10^4$ I ∞

Note

- Use the control type **Input TTL (Single pin)** to wait for a rising or falling input signal. The manual operation will be ended as soon as an input signal is received or the maximum waiting time is exceeded.

For Control type = Stirrer, the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Speed	Defines the stirring speed in [%].	0…100
Duration	The time, in [sec], the auxiliary instrument should be switched on. Select "∞" for unlimited time.	0…10^4 I ∞

Note

- An auxiliary instrument controlled by the control type **Stirrer** can be switched on and off or operated for a defined period of time.

For Control type = RS-232, the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Connection	The serial port to which the device is connected.	COM
Output sequence	Defines the output sequence to be transmitted by the titrator. ASCII control characters are generated with sequences started by the backslash character followed by three digits. For example: \013 for Carriage Return \010 for line feed.	ASCII characters
Wait for response	Defines whether the system should wait for a response sequence from the device.	Activ I Inactive
Input sequence	The response sequence from the external device. Only if **Wait for response** = **Active** was selected.	Arbitrary
Max. wait time	The maximum waiting time for a signal change. After it expires, the method will be continued even if no input sequence was detected. Only appears for **Mode** = **Input controlled**.	0…10^4 I ∞

Note

- Use the control type **RS-232** to transmit any signal and (if you so specify) to wait for a response.

10.5 Burette

10.5.1 Rinse burette

Navigation: **Home** > **Manual** > **Burette** > **Rinse**

This operation lets you rinse a burette and its connecting tubes and fill it with fresh titrant, for example if you want to remove air bubbles from the system.

1 Select the titrant you want to rinse with.
2 Select the drive on which the titrant is installed. (For PnP burettes, the system automatically selects the appropriate drive.)
3 Enter the number of cycles you want to run.
4 Enter the discharge volume in [%] to define the percentage of the burette's total volume that you want to discharge during each rinse passage.
5 Enter the filling rate in [%] to define the speed at which you want to refill the burette. (100% is the maximum rate.)
6 Tap **Start** to start the procedure.

⇨ The procedure starts. Tap **Stop** to stop the procedure at any time.

Note

- Make sure that the dispensing tube is directed into a vessel which is a multiple of the volume of the burette.
- For reagents with a higher viscosity or volatile reagents, we recommend reducing the filling rate to prevent air from being drawn in and the titrant from outgassing.

You can determine the following parameters:

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Drive	Defines the drive on which you will use the burette containing the titrant.	List of available drives
Cycles	Defines the number of rinse cycles to be executed.	1…100
Discharge volume	The volume of titrant, in [mL], to be discharged during the rinsing process.	10…100
Fill rate	The filling rate of the burette in percent. 100% stands for maximum filling rate.	30…100

10.5.2 Rinse multiple burettes

Navigation: **Home** > **Manual** > **Burette** > **Rinse multiple burettes**

Two burettes can be rinsed at the same time using this manual operation.

1 Select the corresponding drives to rinse the burettes with titrant.
2 Enter the number of cycles during which rinsing is to take place.
3 Tap **Start** to start the procedure.

⇨ The procedure starts. Tap **Stop** to stop the procedure at any time.

You can determine the following parameters:

Parameters	Description	Values
Drive 1…Drive 2	Drives on which the burettes with titrant are installed.	Activ I Inactive
Cycles	Defines the number of rinse cycles to be executed.	1…100

Note

- The drives can only be seen if they are connected.
- Drives that are equipped with a PnP burette are opened again at the specific fill rate of the titrant, whereas conventional drives are opened at 100% fill rate.

10.5.3 Dispense

Navigation: **Home** > **Manual** > **Burette** > **Dispense**

This manual operation lets you manually dispense a defined quantity of titrant.

1 Select the titrant you would like to dispense.
2 Select the drive on which the titrant is installed. (For PnP burettes, the system automatically selects the appropriate drive.)
3 Enter the volume to be dispensed in [mL].
4 Enter the filling rate in [%] to define the speed at which you want to refill the burette. (100% is the maximum rate.)
5 Tap **Start** to start the procedure.

⇨ The procedure starts. Tap **Stop** to stop the procedure at any time.

You can determine the following parameters:

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Drive	Defines the drive on which you will use the burette containing the titrant.	List of available drives
Volume	Defines the volume to be dispensed, in [mL].	0.001…100

Fill rate	The filling rate of the burette in percent. 100% stands for maximum filling rate.	30…100

10.5.4 Manual titration

Navigation: **Manual** > **Burette** > **Manual titration**

To perform a manually controlled titration, proceed as follows:

1 Select the titrant you would like to titrate with.

2 Select the drive on which the titrant is installed. (For PnP burettes, the system automatically selects the appropriate drive.)

3 Enter the filling rate in [%] to define the speed at which you want to refill the burette. (100% is the maximum rate.)

4 Select the sensors you would like to use for the measurement from the list of sensors defined in the setup.

5 Select the stirrer output for the stirrer and enter a speed.

6 Specify whether the temperature should be entered manually or automatically.

7 For manual temperature acquisition, enter the temperature.
- or -
For automatic temperature acquisition, select a connected temperature sensor and the temperature unit to be used.

8 Select whether the results should be given in the form of consumption (of the titrant) or content (in the sample).

9 Select the measurement unit and the number of decimal places for the results.

10 For results given as content, select the sample's entry type (**Volume** or **Weight**) and enter the sample quantity m, the density d (for entry types **Volume** or **Weight**), the molar mass M and the equivalent number z for the substance to be tested.

11 Specify whether a record should be output to the printer and select which elements should be contained in that record (**Results**, **Table of measured values** and **Curve**).

12 Tap **Start** to start the manual titration and move to the online dialog.

13 Tap **Dispense** once to add a minimum volume of titrant. If you touch and hold **Dispense**, the system will continuously add titrant.
   ⇨ The dispensing rate will increase as you hold down the button.
   ⇨ After you release the button, the system will titrate at the minimum speed again the next time you tap the button.

14 Tap **Exit** to end the manual titration.

During the manual titration, the system will display the measured value, the titrant consumption, and a curve (measured value versus consumption) on the screen. After you finish, a record can automatically be output to the printer. You can also view the results, measured values and curve on the screen.

Note

- For the results of the manual titration, the system takes as a basis the titrant consumption until the conclusion of the titration. The EQP is not calculated!

You can determine the following parameters:

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Drive	Defines the drive on which you will use the burette containing the titrant.	List of available drives
Fill rate	The filling rate of the burette in percent. 100% stands for maximum filling rate.	30…100
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Sensor input	The input to which you want to connect the sensor.	SENSOR I PT1000
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I pH I ppm I pM I pX I %T I A I µA I °C I K I °F

Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Speed	Defines the stirring speed in [%].	0…100
Temperature manual	Defines whether to enter the temperature manually (**Active**) or via a temperature sensor (**Inactive**).	Activ I Inactive
Temperature	If the temperature is entered manually, you can enter it here, in [°C]. Only appears if **Temperature manual** = **Active** was selected.	-20…200
Temperature sensor	Here you can select the required temperature sensor. Only appears if **Temperature manual** = **Inactive** is selected.	List of available sensors
Sensor input	The input to which you want to connect the sensor.	SENSOR I PT1000
Temperature unit	The unit of measure for the temperature measurement. Only appears if **Temperature manual** = **Inactive** was selected.	°C I K I °F
Result	Select whether to output the result of the manual titration as the amount of titrant consumed or as the content in the sample.	Consumption I Content
Unit	The unit for stating the result in the form of the titrant consumption. Only for **Result** = **Consumption**.	mL I mmol
Unit	The unit for stating the result as the sample content. Only for **Result** = **Content**.	mol/L I mol/kg I g/L I g/kg I % I ppm
Decimal places	Specify the required number of decimal places for the results.	1…4
Entry type	The entry type for the sample size. Only for **Result** = **Content**	Weight I Volume
Sample size	The sample size, in [mL] or in [g], depending on the entry type selected. Only for **Result** = **Content**.	0.0001…100
Density	The density of the sample substance to be determined, in [g/mL]. Only for **Result** = **Content**.	0.0001…100
M [g/mol]	Defines the molar mass of the substance [g/mol]. Only in method function **GT** (general titration).	List of concentration/ titer standards and substances
Record	Defines whether to output a record to the printer after the titration.	Activ I Inactive
Incl. result	Here you can specify whether the record should contain all the results. Only appears for **Record** = **Active**.	Activ I Inactive
Incl. table of measured values	Here you can specify whether the record should contain a table of measured values. Only appears for **Record** = **Active**.	Activ I Inactive
Incl. curve	Here you can specify whether the record should contain a curve. Only appears for **Record** = **Active**.	Activ I Inactive

Note

- The parameters for temperature acquisition or entering the temperature, **Temperature manual**, **Temperature**, **Temperature sensor**, **Sensor input** and **Temperature unit** are omitted for mV sensors and the phototrode.

11 Analysis Sequences

11.1 Starting an Analysis

An analysis can be started on the titrator in several different ways:

1. By choosing one of the following buttons:
   - **Start** from the method editor
   - **Start** from the home screen
   - **Start** from the **Series** widow
   - **Setup** > **Chemicals** > **Titrant** > **Titrant parameter** > **Titer** to perform a titer determination in Setup.
2. Using a user-specific shortcut or a direct shortcut from the home screen.

When you create a shortcut by choosing **AddToHome** (see "Description of Functions > The User Interface > Shortcuts and Direct Shortcuts"), the following parameters are available:

Parameters	Description	Values
Description	Any name for the shortcut.	Arbitrary
Immediate start	The method, series, or manual operation can be started immediately. This enables you to start the analysis without any interfering dialog.	Activ I Inactive
Homescreen position	Defines the position of the shortcut on the homescreen.	-

After you create the shortcut, it appears in the selected position in "Home", from where you can select it by tapping the touchscreen.
When you start an analysis, whether by using a button or with a shortcut, the system always opens the **Start analysis** dialog (see "Descripton of Functions > The User Interface > The Start Analysis Dialog"). The only exceptions are direct shortcuts ("Immediate start" = "Yes"), whose selected settings permit a direct start.

At the start of an analysis, you can still make changes to various settings in the **Start analysis** dialog. It is therefore possible, for example, to modify the sample size and define the number of samples to be determined.

If the analysis you want to start is a single determination, you can enter the sample size or sample ID directly as a parameter in the **Start analysis** dialog.
In general, the sample data can be entered for each individual sample using the **Samples** button in the **Start analysis** dialog. In the **Sample data** dialog that opens when you choose this button, a list of the individual samples is displayed.

In addition, the status is displayed for every sample (regardless of the loop type) in the **Sample data** dialog. The following status levels can be assigned to a sample:

- **Idle**: The sample is not yet running and the sample data can still be edited
- **Running**: The sample is running but the sample data can still be edited
- **Active**: The sample is running and the sample data can no longer be edited
- **Done**: Done – the sample has run and concluded and the sample data can no longer be edited

If you select a sample, you can define the following sample data.

To enter sample data, tap on **Sample** in the **Start analysis** window. The **Sample data** window opens. You can select an entry in the list or you can tap on **New** to specify the sample data via the following parameters:

Parameters	Description	Values
Number	Defines the number of the sample.	1…303
ID 1	The ID for the first or only sample of an analysis.	Arbitrary
Sample size	You can enter the sample size here. For fixed entry types, this field only appears as an info field.	0…1000 [g] I [mL] 0…10^6 [pcs.]
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000

Density	You can enter the sample's density, in [g/mL], here. Does not appear for the **Entry type** = **Pieces** and **Fixed pieces**.	0…100
Comment	You can enter a brief comment about the series.	Arbitrary
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

You can enter the following parameters in the **Start analysis** dialog, depending on the type of analysis to be started and the resources used:

Parameters	Description	Values
Type	The type of analysis to be started.	Method I Series
Number of samples	Defines the number of samples to be analyzed. The number depends on the selected titration stand.	1…303
Number of standards	The number of standards to be analyzed with a method or series.	1…303
ID 1	The ID for the first or only sample of an analysis.	Arbitrary
Sample type	Defines the type of sample used in the sample loop. The sample type is shown in the method editor, the sample data window and the report.	Sample I Standard I Blank
Sample size	You can enter the sample size here. For fixed entry types, this field only appears as an info field.	0…1000 [g] I [mL] 0…10^6 [pcs.]

- All the parameters that can be edited in the **Start analysis** dialog or the sample data dialog will overwrite the settings defined in the method for the same parameters.
- All non-editable parameters that are displayed as an info field are only shown for orientation purposes and list the settings from the method.
- If the sample size must be entered before the analysis but the user does not do so, the user will be required to enter it immediately before the start of the analysis.

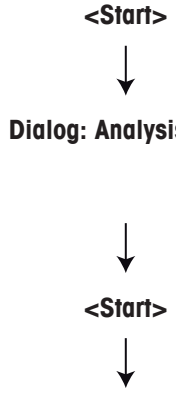
11.2 Analysis Sequence Steps

During the processing of an analysis, starting from the start of the analysis and sample addition through to the results display, the titrator displays a range of dialog windows, some of which the user has to confirm in order for the analysis to continue. These dialog windows are used to ensure faultless processing, and also to provide the user with information.
Depending on the required degree of automation for an analysis, it can, however, be useful and desirable to deactivate particular security questions or information dialogs to ensure that the sequence is processed without interruption. Below are some process flow examples.

11.2.1 Analysis sequence

For GT analyses, the sequence with the use of a manual or with the use of an automatic titration stand is shown. In each case, you are told where the individual screens can be switched off in the user interface.

- Analysis sequence for an analysis with a titration stand of the type "Manual stand":



Can be switched off for the start via shortcut with the "Immediate start" parameter during the creation or management of a shortcut.

Check: Resources

Can be switched off with the "Show required resources at start" parameter in the analysis sequence settings. (An error message will appear if the resources have already been allocated or are missing.)

↓

<OK>

↓

Request: Sample size

Appears when "Entry" = "Before" was selected in the "Sample" method function and the sample size = 0. Can be avoided by selected a "fixed" entry type.

↓

<OK>

↓

Add sample

Can be switched off for the start via shortcut with the "Immediate start" parameter during the creation or management of a shortcut for the first sample.

↓

<OK>

↓

Dialog: Online

↓

Request: Sample size

For "Entry" = "Arbitary" parameter in the "Sample" method function.

↓

<OK>

↓

Results

This can be switched on or off via the "Show results after analysis" parameter.
(Navigation: Setup > Global settings > Analysis and resources behavior > Analysis sequence setting).

↓

<OK>

↓

Homescreen / Analysis start

- Analysis sequence for an analysis with a titration stand of the type "Auto stand" or "Rondolino TTL":

<Start>

↓

Dialog: Analysis start

Can be switched off for the start via shortcut with the "Immediate start" parameter during the creation or management of a shortcut.

Can be switched off with the "Show required resources at start" parameter in the analysis sequence settings (Navigation: Setup > Global settings > Analysis and resources behavior > Analysis sequence settings).

Can be switched off with the "Show results after analysis" parameter in the analysis sequence settings (Navigation: Setup > Global settings > Analysis and resources behavior > Analysis sequence settings).

Note:
At the end of a series, all results are listed. The display of this list can be switched on or off via the "Show results after analysis" parameter.

12 Analysis Data

The "Analysis data" include different types of data that can be used at various times during the planning and execution of an analysis.

The system differentiates between the following types of analysis data:

Raw data	Raw data are defined when you create a method or series. They are automatically generated and stored during the analyses. Raw data are always created for each analysis and cannot be influenced by the user.
Method data	All data for the method run.
Series data	All data from the series run, such as e.g. the series ID and the number of samples.
Sample data	All data from the analyzed samples, such as e.g. the sample size, sample density and sample ID.
Resource data	Data for all resources used during the execution of an analysis (for example, titrant, auxiliary instrument). The data for a resource are copied from the setup at the time when it is used in an analysis.
Table of measured values	Tables of measured values are created by some method functions during an analysis and can be output in the record.
Raw results	Raw results are data determined by the titrator during an analysis, such as used titrant volumes and measured values. The raw results can be converted into the actual analysis results in the "Calculate" method function using the appropriate symbols and formulas. Some of the raw results are always produced automatically and others are only generated when used within a calculation.
Results	Results are the results of the conversions of raw results run within the "Calculate" method function. The results of an analysis can be influenced by the user.

Of these, the following can be used in calculations:

- Sample data (such as the sample size or the sample density)
- Resource data (e.g. mole quantity and equivalence quantity for a substance)
- Raw results (e.g. blank)
- Results (the results of a calculation can then be used in a subsequent calculation).

13 Titrator Evaluation Procedure

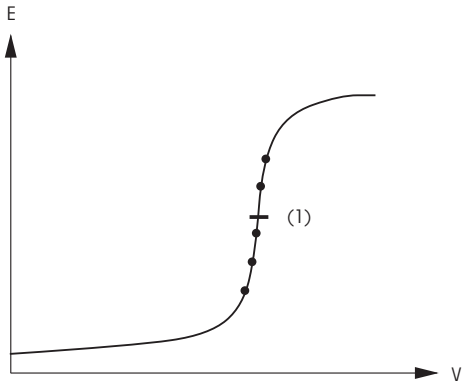
The identification of equivalence point candidates within a defined recognition range can be done using four different evaluation methods:

- Standard
- Minimum / Maximum
- Segmented
- Asymmetric

Which method you use for the evaluation will depend on the type of titration or the form of the resulting titration curve. The procedure to be used is defined in the "Evaluation and recognition" method subfunction of the "Titration (EQP)".

13.1 Standard Evaluation Procedure

The titrator's standard evaluation procedure is based on the chemical model of a classic acid-base titration. In this model, the equivalence point of such a titration will be at the point of inflection of the S-shaped titration curve and the curve will be symmetrical with regard to this inflection point.



For the recognition of an inflection point using the standard procedure, the titrator will always look at one group of measured values (a "measured value window"). It will examine whether an inflection point is detectable for that group of measured values. This window will then be shifted along the curve by one measured value and reexamined for points of inflection. The system repeats this procedure until it detects no inflection point twice in a row. It then uses the inflection points found to define the most suitable one as the final inflection point of the titration.

(1) Inflection point

The standard evaluation procedure initially only identifies points of inflection. Criteria defined by the user in the method can influence whether and when an inflection point is to be registered as an EQP candidate.

If so defined in the method, the following criteria will have to be fulfilled:

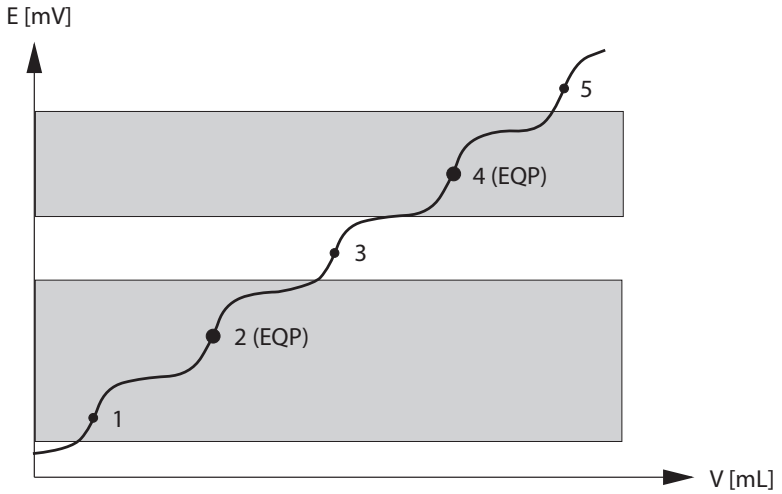
- The inflection point must lie within a recognition range.
- It must be above a threshold (refers to the first derivative).
- The titration curve must demonstrate a specified tendency in the area of the inflection point.

EQPs are only detected in the range of the measured curve which is the specified by the "Tendency" parameter (Positive, Negativ), refer to method function "Titration (EQP): Evaluation and Recognition".

If these criteria are fulfilled, the inflection point becomes an EQP candidate.
The additional EQP criteria can now be used to influence which EQP candidates are ultimately recognized as equivalence points.
For the standard evaluation, the additional EQP criteria "Last EQP" and "Steepest jump" are available. They can be selected individually for each defined recognition range.

Note

These criteria can be defined in the "Evaluation and recognition" subfunction of the "Titration EQP" method functions.



Theoretical example for the evaluation of a titration curve with five points of inflection

Explanation:

This titration curve shows five points of inflection (1 – 5).

Inflection points 1, 2 and 4 are recognized as EQP candidates, since only these points lie within the 2 recognition ranges while also fulfilling the "Tendency" and "Threshold" parameters.
The specified "Additional EQP criteria" then determine whether the EQP candidates are actually recognized as EQP. These additional EQP criteria can be defined for every recognition range.

In the example shown above, the following were specified as additional EQP criteria:

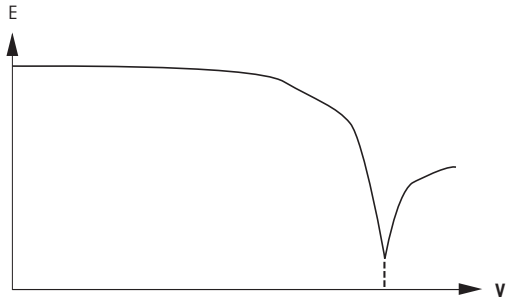
Recognition Range 1: "Last EQP"
Recognition Range 2: "No"

Of the two EQP candidates found in Recognition Range 1, the system only identifies the second one as an EQP due to the "Final jump" criterion. The first one remains merely an EQP candidate.

The termination criterion defined was that the titration should be terminated after the recognition of three EQP candidates ("Termination after EQP" = "3"). In the above example the titration is terminated on identification of the 4th turning point (3rd EQP candidate).

13.2 Minimum / Maximum

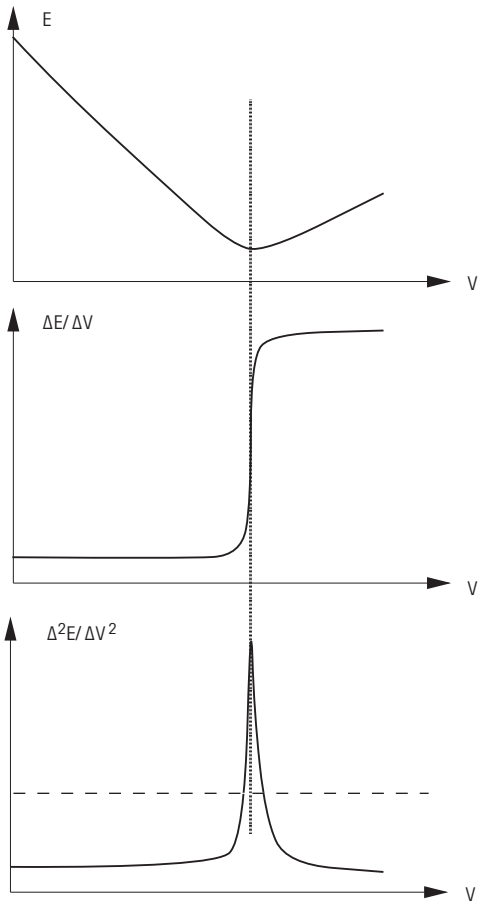
The result of this evaluation is the calculated minimum (maximum) of the measured titration points. The classic example of a titration curve with a minimum is the photometrically indexed surfactant determination.



The minimum (maximum) is calculated using a polynomial approximation of the titration curve in the range of the minimum (maximum). The equivalence point recognition is done directly from the titration curve data.

13.3 Segmented Evaluation

Various indication methods (including photometry, conductometry, and amperometry) generate titration curves with linear or approximately linear sections (segmented curves). The titrator uses individual procedures to evaluate these curves. For a precise determination of the equivalence point, it is very important that these curves have both linear segments and a clear bend.



Titration curve

The titration curve contains two more less linear segments and a bend between these two segments. The evaluation of segmented curves is generally done with the aid of the standard procedure for S-shaped curves, with the system using as its evaluation basis not the titration curve's measured points but the data calculated from them in the first derivative.

1. Derivative

The first derivative of a segmented curve is the first to demonstrate the typical S shape. Its inflection point is the titration's equivalence point.

2. Derivative

The threshold references the second derivative of the titration curve. In other words, the equivalence point for a defined threshold must be above this threshold number.

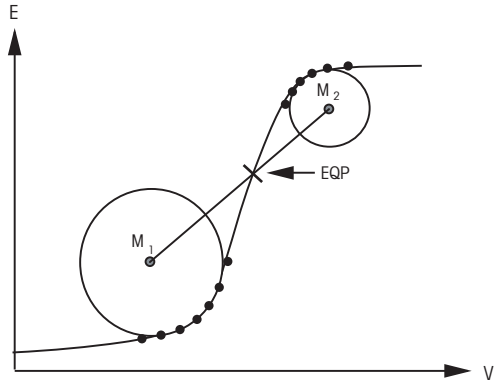
EQPs are only detected in the range of the measured curve which is the specified by the "Tendency" parameter (Positive, Negativ), refer to method function "Titration (EQP): Evaluation and Recognition". Within the segmented procedure the tendency refers to the 1. derivative.

13.4 Asymmetric

For markedly asymmetrical curves, the standard procedure can result in a systematic error. The difference between the true equivalence point and the point of inflection can be greater than the normally achievable precision. For these cases, the titrator uses an evaluation that uses the Tubbs method.

This empirical approximation method is a procedure for the evaluation of asymmetrical, analog-registered titration curves. It can also be used for digitally recorded titration curves. The Tubbs procedure result will be closer to the true equivalence point for some asymmetrical curves than the inflection point.

This evaluation procedure is based on the following considerations:



Each of the two branches of the titration curve will have a writable osculating circle with a minimal radius. The relationship between the two radii is determined by the curve's asymmetry. The intersection of the connecting lines between the circle center points M1 and M2 and the titration curve produces the desired equivalence point. Theoretical calculations show that the true equivalence point for asymmetrical titration curves will always lie between the inflection point and the branch of the titration curve with the greater degree of curvature (i.e. the smaller osculating circle).

The titrator uses a hyperbola to approximate those parts of the titration curve located in the area of the greatest curvature. For each approximated hyperbola, the system determines the peak (the point with the greatest curvature). The center points of the assigned smallest osculating circles are the focal points of both hyperbolas. The intersection of the connection lines from the two focal points and the titration curve produces the desired equivalence point, as shown above.

The evaluation requires at least six measured values in the area of the greatest curvature before and after the titration curve's inflection point. If the course of the titration curve does not permit the inclusion of the osculating circles, the titrator will use the standard procedure to calculate the equivalence point. You will be notified of this in the record of the "raw results".

EQPs are only detected in the range of the measured curve which is the specified by the "Tendency" parameter (Positive, Negativ), refer to method function "Titration (EQP): Evaluation and Recognition".

14 Transporting the titrator

If you transport the titrator over long distances, use the original packaging.

1 Empty all tubes.
2 Empty the titration vessel.
3 Shut down the titrator.
4 Unplug the titrator.
5 Remove all cable connections.
6 Remove the titration vessel from the titration stand.
7 Remove all tubes.
8 Remove all burettes.
9 Move the titrator to the new location.

15 Care and maintenance

15.1 Cleaning

Housing of the titrator

1 Unplug the titrator.

2 Clean the housing of the titrator using a cloth moistened with alcohol.

Titration stand

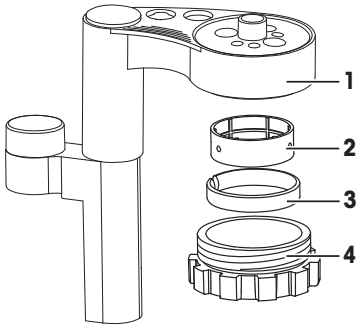
1 Loosen the threaded ring (4) and remove it from the titration stand (1).

2 Remove the clamping ring (3) and the spacing ring (2) from the titration stand (1).

3 Clean the parts of the titration stand.

4 Place the clamping ring (3) and the spacing ring (2) in the threaded ring (4).

5 Screw the threaded ring (4) into the titration stand.



15.2 Maintenance

Mettler Toledo recommends that a preventive maintenance and calibration certification is done at least once a year through your local Mettler Toledo Service Organization.

NOTICE

Danger of damage to the titrator through leaking burettes!

Substances leaking out of burettes can enter the housing and damage parts of the installed boards.

– Check the burettes for leaks and replace leaking burettes.

Daily

- Remove the burettes from the titrator.
- If you work with corrosive substances, rinse the burettes.
- If you work with corrosive substances, check the burettes for leaks and replace leaking burettes.

Weekly

- If you use the burettes daily, check the burettes for leaks and replace leaking burettes.

Before periods of inactivity

1 Rinse the burettes.

2 Empty all tubes.

3 Empty the titration vessel.

4 Shut down the titrator.

5 Unplug the titrator.

6 Remove the titration vessel from the titration stand.

7 Remove all tubes.

8 Remove all burettes.

16 Disposal

In conformance with the European Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) this device may not be disposed of in domestic waste. This also applies to countries outside the EU, per their specific requirements.

Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment. If you have any questions, please contact the responsible authority or the distributor from which you purchased this device. Should this device be passed on to other parties (for private or professional use), the content of this regulation must also be related.

Thank you for your contribution to environmental protection.

17 Technical data

17.1 Titrator

Power supply	Input voltage	100…240 V AC ±10 %
	Input frequency	50–60 Hz
	Primary connection socket	3 pin, IEC C14
	Power consumption	24 VA
	Connected load	24 V DC, 1.25 A
	Secondary connection plug	2 pin, DC plug
CPU	Processor	Arm Cortex
	SDRAM	512 MB
	Flash memory	1 GB (industrial SD card)
Dimensions	Width	210 mm
	Depth	333 mm
	Height	308 mm (with titration stand)
		320 mm (ready-to-operate device)
	Weight	4.2 kg
Materials	Titrator housing	Crastin® PBT
	Cover sheet	PET
	Protective cover	Copolymer
	Chassis	Stainless steel
	Titration stand	Crastin® PBT
	Lid (titration beaker)	Polypropylene
	Threaded ring	Polypropylene
	Three hole adapter	Polypropylene
	Dispensing tube / extraction tube	FEP
	Air tubes	Silicone
	O-ring (screw top)	EPDM
	O-ring (threaded ring)	FEP / silicone
	Sealing ring (bottle)	PTFE / silicone
	Seal (dispensing tube / extraction tube)	PTFE
	Connecting piece	Polypropylene
Ambient conditions	Ambient temperature	+5 °C - 40 °C
	Relative humidity	Max. 80 % (non-condensing) at 31 °C, linear fall to 50 % at 40 °C
	Use	In interior spaces
	Overvoltage category	II
	Pollution degree	2
	Max. installation height	2000 m (above sea level)
COM	Socket	9-pin male D-sub
	Configuration	Full-duplex
	Baud rate	1200…19200
	Handshake	X-On / X-Off
	Galvanic isolation	No
	ESD stability	Min. 1000 V
	Short-circuit protection	Yes

USB1 / USB2	USB host	USB full speed
	Max. power load	700 mA max. for each port
PC	USB client	USB 2
Ethernet	Socket	RJ45
	Speed	10/100 MBit/s
TTL-I/O	Socket	9-pin female D-sub
	Inputs	2
	Outputs	4
	Galvanic isolation	No
CAN OUT	Socket	RJ12
	Speed	500 kBit/s
	Voltage	24 VDC ±10%
	Current	Max. 500 mA
Stirrer / pump	Socket	5-pin mini-DIN
	Pump detection	Yes
	Stirrer detection	Yes
	Pump voltage	24 V DC ±5 % 400 mA maximal current for normal operation
	Stirrer voltage range	0 to 18 V DC ±10 % 300 mA maximal current for normal operation
SENSOR		
pH/mV sensor input	Socket	Triaxial
	Measuring range	± 2000 mV
	Resolution	0.1 mV
	Limits of error	0.2 mV
Polarized sensor input: Upol	Voltage source: Range	0...2000 mV AC
	Voltage source: Resolution	0.1 mV
	Voltage source: Limits of error	12 mV
	Measuring range	0 ...200 µA
	Resolution	0.1 µA
	Limits of error	0.2 µA
Polarized sensor input: Ipol	Current source: Range	0...24 µA AC
	Current source: Resolution	0.1 µA
	Current source: Limits of error	1.2 µA
	Measuring range	0 - 2000 mV
	Resolution	0.1 mV
	Limits of error	2 mV
pH Reference input	Socket	4 mm
Temperature input	Socket	4-pin LEMO
	Sensor	Pt1000
	Measuring range	-20 - 130 °C
	Resolution	0.1 °C
	Limits of error	0.2 °C

Burette drive	Drive	Stepper motor
	Resolution	1/20000 of the burette volume
	Limits of error	0.2% of the respective volume
	Filling time	Minimum 20 sec at 100% filling rate
	Discharge time	Minimum 20 sec
	Burette detection	Yes
	Thread length	50 mm
	Thread pitch	1 mm
	Resolver (magnetic)	32 pulse/360°
	Pulse / full stroke	1600
	Resolver resolution	0.0625% of burette volume
Interchangeable burettes	Volume	1, 5, 10 and 20 ml
	Drive and burette limits of error	According to ISO 8655-3
	Materials that come into contact with titrants	Fluoroplastic, borsilicate glass, ceramic
Display	Technology	Color TFT
	Size	5.7"
	Resolution	VGA 640 x 480 pixels
	Backlighting	LED
	Brightness control	Per software 50–100%
Input	Technology	Full-coverage resistive touchscreen

Power Management

The devices have a power management system which prevents the titrator from switching off unexpectedly in the event of a power overload. Tasks which would cause a power overload, because a number of pumps, stirrers and burette drives are already in use, cannot be started at all. A notification brings the start attempt to the attention of the user. It is advisable, if possible, to connect pumps and stirrers directly to sample changers or other devices which have their own power supply, such as a TBox, instead of to the titrator itself.

17.2 Supported peripherals

Balances

Balances can connect to the COM interface of the titrator. METTLER TOLEDO balances must be equipped with an RS-232 interface or an appropriate adapter. For a list of connection cables, see "Optional accessories".

Manufacturer	Type	RS	LocalCan	Note
METTLER TOLEDO	AB / PB	•	•	COM ports
	AB-S / PB-S	•		COM ports
	AG / PG / PR		•	COM ports
	AT / MT / UMT	•		COM ports
	AX / MX / UMX	•	o	COM ports
	PG-S	•	o	COM ports
	XP	•	o	COM ports
	XS	•	o	COM ports
	MS	•		COM ports
	ML	•		COM ports
Sartorius	Various	•		COM ports

• Standard o Option

Printer

Printers can be connected to the USB1 or USB2 interface of the titrator. PCL-compatible printers from various manufacturers are supported. The METTLER TOLEDO USB-P25 is a robust and easy-to-operate matrix printer which prints onto standard quality paper. A current list of supported printers can be found on the Internet at: http://www.mt.com/titration-printers.

Manufacturer	Type	Note
Various	Generic PCL printers	Connection via USB1 or USB2
METTLER TOLEDO	USB-P25	Connection via USB1 or USB2
METTLER TOLEDO	P-56RUE	Connection via USB1 or USB2
METTLER TOLEDO	P-58RUE	Connection via USB1 or USB2

Note

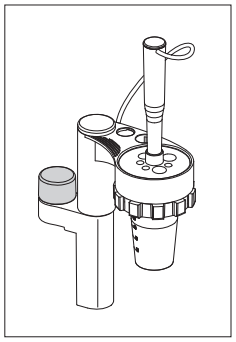
A standard USB hub can be used if more than two devices are to be connected to the USB connections of the titrator.

18 Optional accessories

All parts are specified with their ordering code and quantity in cases where more than one part is included. When ordering, some parts are only available in a minimum order quantity. In such cases, the corresponding minimum order quantity is quoted. The standard equipment and optional accessories for auxiliary equipment, e.g. sample changers, are listed in the appropriate operating instructions.

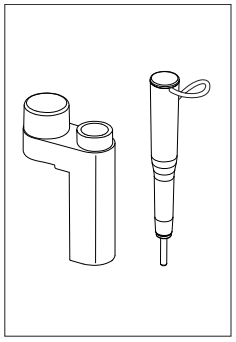
All items that are optionally available for your compact titrator are listed below. Compatibility of optional accessories depends on the titrator type. Check with your local sales representative.

18.1 Titration kits



The manual titration kit contains: **51109220**

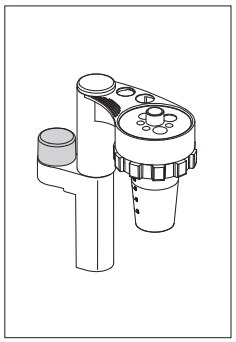
- Manual titration stand, complete
- Compact stirrer
- Propeller stirrer
- Magnetic stirrer bar



Auto titration kit, consisting of: **51109221**

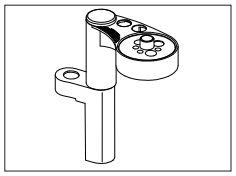
- Electrode holder assembly
- Compact stirrer
- Propeller stirrer

18.2 Titration stands

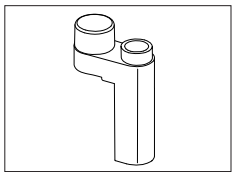


Manual titration stand, complete, set contains: **51109190**

- Titration stand
- Fastening screw
- Spacing ring
- Clamping ring
- Threaded ring
- Titration vessel
- Stopper
- Ground joint adapter
- Electrode sleeve

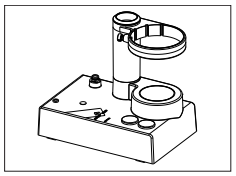


Titration stand without accessories **51109118**

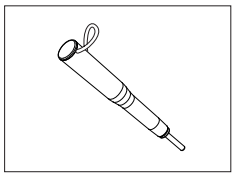


Electrode holder set, consisting of: **51109195**

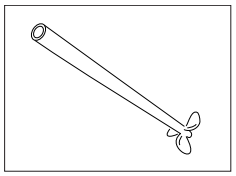
- Electrode holder
- Fastening screw
- Electrode sleeve



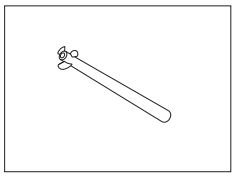
DV704 External titration stand with magnetic stirrer **51109259**



Compact stirrer
incl. 2 propeller stirrers **51109150**

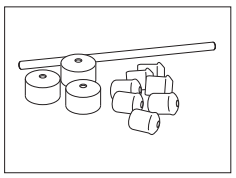


Propeller stirrer
(minimum ordering quantity: 3 pcs.) **101229**

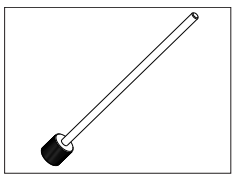


Micro-propeller stirrer **655073**

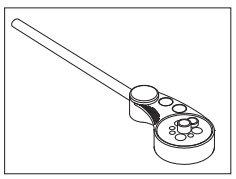
Rinsing unit with titration head insert, stoppers and manual dispenser. **23821**



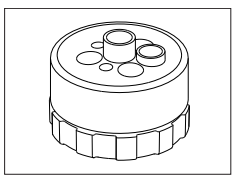
Set of stoppers for rinsing unit **101230**



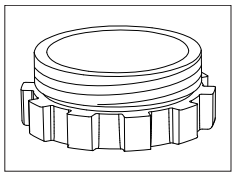
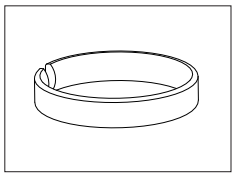
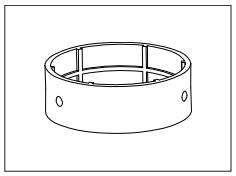
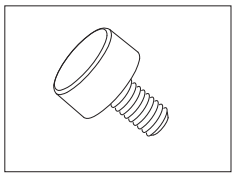
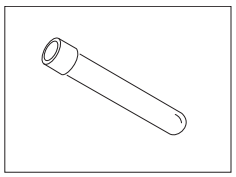
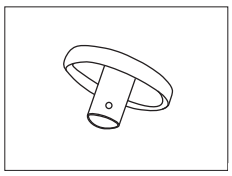
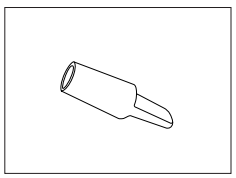
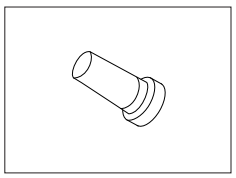
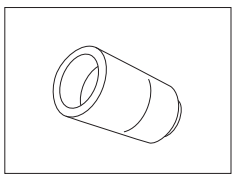
Stand rod **51107495**

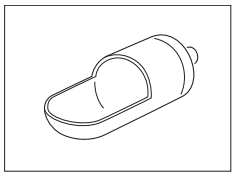


External Titration Stand with rod **51109270**

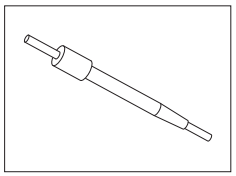


Titration head **51107458**

	Threaded ring	**25652**
	Clamping ring	**25653**
	Spacing ring	**23842**
	Clamping screw	**51109084**
	Electrode sleeve	**25654**
	Cap (for titration stand)	**51107608**
	NS 14.5 stopper	**23451**
	NS 7.5 stopper	**23452**
	Adapter for dispensing tube	**51109169**

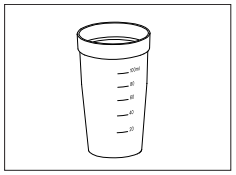


Weighing boats (5 pieces.)
Glass dia. 20 x 60 **23951**
Glass dia. 30 x 80 **23952**
PE dia. 38 x 100 **23954**

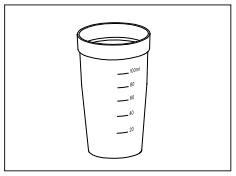


Gas inlet **23721**

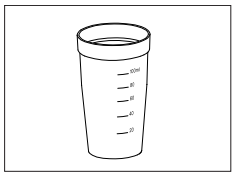
18.3 Titration vessels



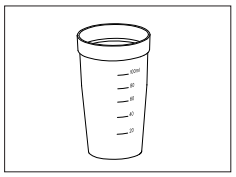
Beakers PP (120 pcs.) **51109388**
100 mL, polypropylene, standard



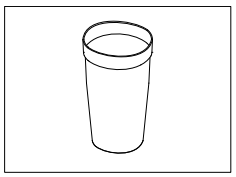
Beakers PP (480 pcs.) **51109389**
100 mL, polypropylene, standard



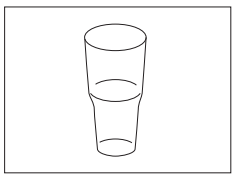
Beakers PP (1400 pcs.) **101974**
100 mL, polypropylene, standard



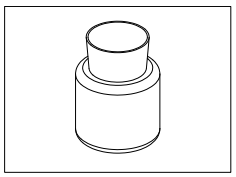
Beakers PP red (1400 pcs.) **25777**
100 mL, polypropylene



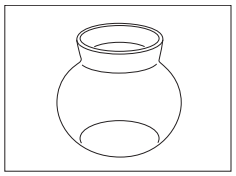
Glass beakers 100 mL **101446**
20 pcs.



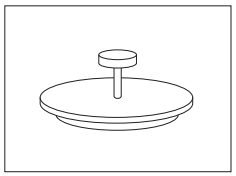
Glass titration vessels, 5 - 20 mL **51108125**
(set of 20 pcs.)



Thermostatable beaker 100 mL **23517**
1 pcs

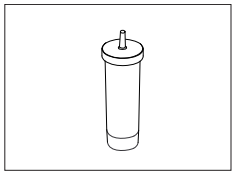


Glass titration vessels, 250 mL
(set of 10 pcs.) **23515**

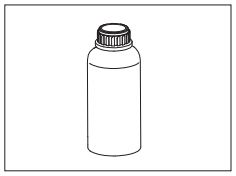


Plastic cap for titration vessels
(set of 16 pcs.) **101448**

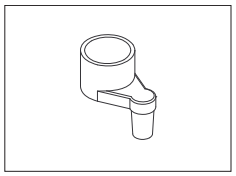
18.4 Drying tubes



Drying tube with cover **23961**

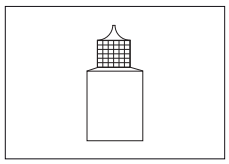


Molecular sieve
250 g **71478**

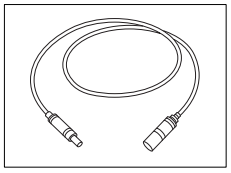


Drying tube holder **23915**

18.5 Sensors

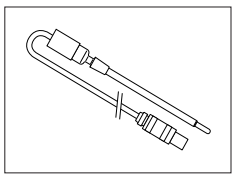


3 Mol/L KCl (25mL) **51343180**



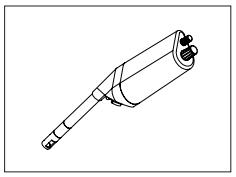
Sensor Extension Cable LEMO 120 cm **30259608**

18.5.1 Temperature senors



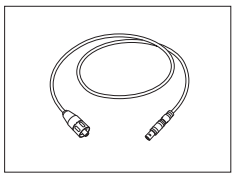
DT1000 temperature sensor
150 mm **51109828**

18.5.2 Color sensors



DP5 phototrode
(incl. power supply unit) for color indicated titrations, transmission measurement at 520, 555, 590, 620, 660 nm — **51109300**

18.5.3 Plug & Play titration electrodes

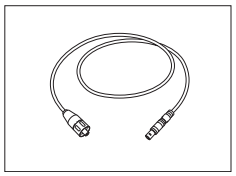
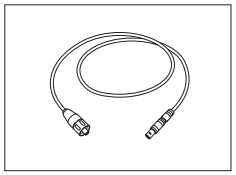


Triaxial SC LEMO cable
Length: 72 cm — **89601**
Length: 100 cm — **89602**
Length: 160 cm — **51108034**
(For Plug & Play – and traditional titration electrodes)

DGi101-SC	PnP combined pH electrode (ceramic diaphragm) for small volumes in aqueous medium.	**51109507**
DGi102-Mini	PnP combined pH electrode (ceramic diaphragm) for small volumes in aqueous medium.	**51109508**
DGi112-Pro	PnP combined pH electrode (moving sleeve junction) for direct pH value measurements and acid/base titrations in complex, aqueous matrixes (for example, galvanic baths, condensation)	**51109501**
DGi113-SC	PnP combined pH electrode (moving sleeve junction) for titration in non-aqueous media.	**51109502**
DGi114-SC	PnP combined pH electrode (moving sleeve junction) for direct pH value measurements and titrations in complex, aqueous media	**51109503**
DGi115-SC	PnP combined pH electrode (with sleeve junction) for direct pH value measurements and acid/base titrations in aqueous media with low ion concentration.	**51109504**
DGi116-Solvent	PnP combined pH electrode (moving sleeve junction) for titration in non-aqueous media.	**51109505**
DGi117-Water	PnP combined pH electrode with sleeve junction and integrated temperature sensor for direct pH value measurements and acid/base titrations with simultaneous temperature acquisition in low-ion or weakly buffered aqueous media	**51109506**
DMi101-SC	PnP combined platinum ring electrode (ceramic diaphragm) for redox titration with small volumes	**51109523**
DMi102-SC	PnP combined silver ring electrode (ceramic diaphragm) for argentometric titration with small volumes	**51109533**
DMi140-SC	PnP combined platinum ring electrode (ceramic diaphragm) for redox titration	**51109520**
DMi141-SC	PnP combined silver ring electrode (ceramic diaphragm) for argentometric titrations	**51109530**
DMi144-SC	PnP combined platinum ring electrode (ceramic diaphragm) for redox titration, in particular for CSB titration using the Rondo sample changer	**51109521**

DMi145-SC	PnP combined silver ring electrode with moving sleeve junction for argentometric titrations in complex samples	**51109531**
DMi147-SC	PnP combined platinum ring electrode for redox titration at a constant pH value	**51109522**
DMi148-SC	PnP combined silver ring electrode for argentometric titrations at a constant pH value	**51109532**

18.5.4 Classical electrodes (not Plug & Play)

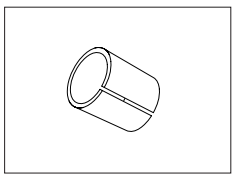
DG111-SC	Combined pH electrode for titrations in aqueous medium	**89596**
DG113-SC	Combined glass electrode with moveable sleeve junction for titrations in non-aqueous medium	**89632**
DG115-SC	Combined glass electrode with sleeve junction for titrations in aqueous medium	**89806**
DM140-SC	Combined platinum ring electrode for redox titrations	**89598**
DM141-SC	Combined silver ring electrodes for argentometric titration	**89599**
DM143-SC	Double platinum pin electrode	**51107699**
DX200	Reference electrode for ion selective electrodes	**89935**
Au805-S7/120	Half-cell with gold ring for RedOx titration of highly oxidizing samples	**59904381**
Sb850-S7/120	Half-cell with antimony for acid/base titration, plastic shaft	**59904405**
PT885-NS-S7/105	Double platinum ring electrode for measuring very low brom indexes.	**59904435**
	Triaxial SC Lemo (Classic) Length: 72 cm Length: 100 cm Length: 160 cm (For classic titration electrodes, especially for amperometric and voltametric titrations with DM143-SC)	 **51109183** **51109184** **51109185**
	MultiPin - LEMO / Pt1000 Cable Length: 70 cm Length: 100 cm (For DGi117-Water pH electrode with built in temperature sensor)	 **51109544** **51109545**

18.5.5 Ion-selective and gas-sensitive electrodes (half cells)

DX207	DX207-Li^+ lithium ISE	**51107673**
DX218	DX218-NH_4^+ ammonium ISE	**51340900**
DX219	DX219-F^- fluoride ISE	**51340500**
DX222	DX222-Na^+sodium ISE	**30079616**
DX224	DX224-Mg^{2+} magnesium ISE	**51340263**
DX226	DX226-CN^- cyanide ISE	**51107681**
DX232	DX232-S^{2-} sulfide ISE	**51107675**

DX235	DX235-Cl^- chloride ISE	**51340400**
DX239	DX239-K^+ potassium ISE	**51340700**
DX240	DX240-Ca^{2+} calcium ISE	**51340600**
DX258	DX258-SCN^- thiocyanate ISE	**51107870**
DX262	DX262-NO_3^- nitrate ISE	**51340800**
DX264	DX264-Cu^{2+} copper ISE	**51107678**
DX280	DX280-Br^- bromide ISE	**51340300**
DX287	DX287-BF_4^- tetrafluoroborate ISE	**51107676**
DX312	DX312-Cd^{2+} cadmium ISE	**51107672**
DX327	DX327-I^- iodide ISE	**51107680**
DX337	DX337-Ba^{2+} barium ISE	**51107674**
DX407	DX407-Pb^{2+} lead ISE	**51107873**
DS500	Tenside-sensitive electrode	**51107670**
DS800-TwoPhase	Tenside-sensitive electrode	**51109540**
GSE ammonia	GSE ammonia electrode	**51341000**
GSE nitrogen oxide	GSE nitrogen oxide electrode	**51341100**
GSE carbon dioxide	GSE carbon dioxide electrode	**51341200**

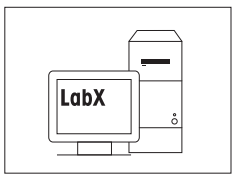
18.5.6 Combined ISE with integrated reference electrode



Adjustable cone for use with sensors **22986**

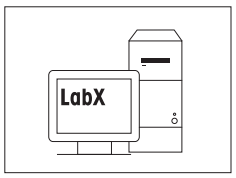
Ag^+/S^{2-}	perfectION™ comb Ag^+/S^{2-} Lemo	**51344800**
Ca^{2+}	perfectION™ comb Ca^{2+} Lemo	**51344803**
Cl^-	perfectION™ comb Cl^- Lemo	**51344806**
CN^-	perfectION™ comb CN^- Lemo	**51344809**
Cu^{2+}	perfectION™ comb Cu^{2+} Lemo	**51344812**
F^-	perfectION™ comb F^- Lemo	**51344815**
I^-	perfectION™ comb I^- Lemo	**51344818**
K^+	perfectION™ comb K^+ Lemo	**51344821**
Na^+	perfectION™ comb Na^+	**51344724**
NO^{3-}	perfectION™ comb NO^{3-} Lemo	**51344827**
Pb^{2+}	perfectION™ comb Pb^{2+} Lemo	**51344830**

18.6 Software



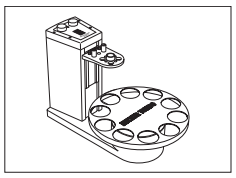
LabX Titration Express **30097754**

- Single PC installation for up to 3 total instrument licenses
- One titrator and balance instrument license

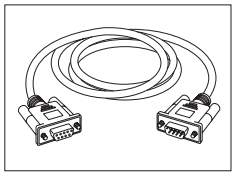


LabX Titration Instrument License (1 pc) **30097756**

18.7 Sample changers

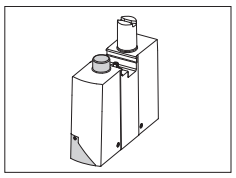


Sample changer **Rondolino** TTL **51108500**

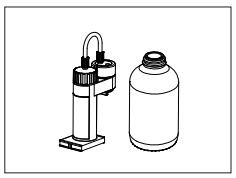


Connection cable for Rondolino (RS9-RS9) **51190589**

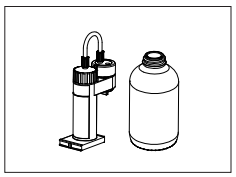
18.8 Dosing and pumps



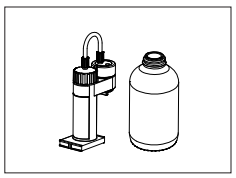
Dosing unit with CAN cable **51109030**



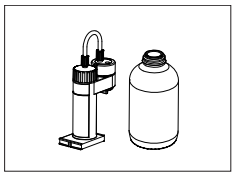
Interchangeable burette DV1005 5 ml **51107500**



Interchangeable burette DV1010 10 mL **51107501**

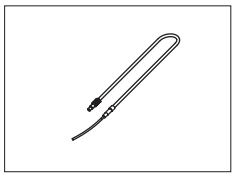


Interchangeable burette DV1020 20 mL **51107502**



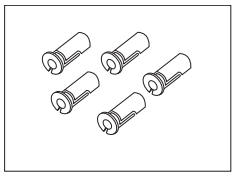
Interchangeable burette DV1001
1 ml

51107503



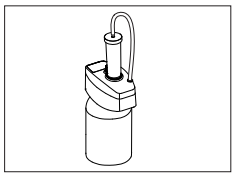
Dispensing tube with siphon tip 100 cm

25961



Siphon tips (5 pcs.)

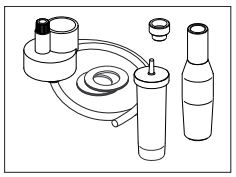
23240



Solvent manager kit

51105652

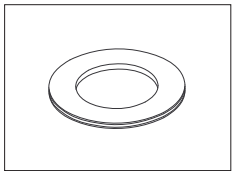
- Solvent manager set
- Clear glass bottle, 1L
- Pump tubing
- Y-cables



Reagent changing set with:

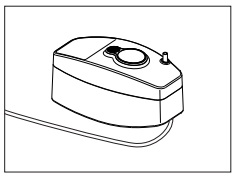
51105606

- Extraction adapter for Coulometer cell
- Park sleeve
- PTFE extraction tube 800 mm (23936)
- Screw top (23937)
- Drying tube with cover (23961)
- 2 flat seals (23981) (minimum order quantity 5 pcs)



Flat seal (minimum order quantity 5 pcs.)

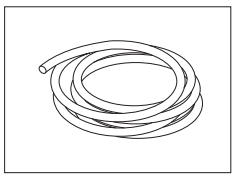
23981



Solvent Manager set with:

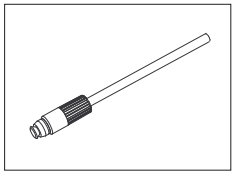
51105600

- Silicone tube 850 mm
- Silicone tube 170 mm
- Drying tube with cover
- 2 flat seals



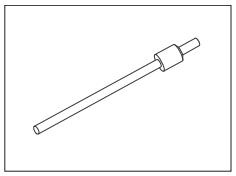
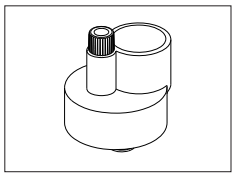
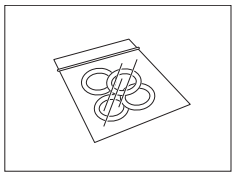
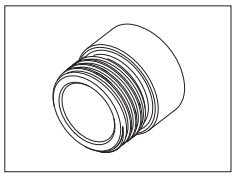
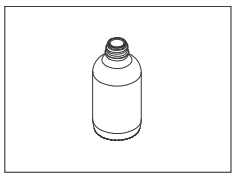
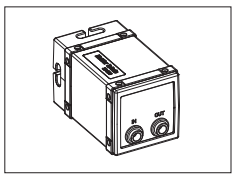
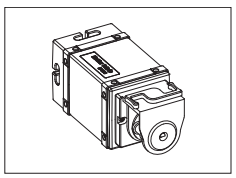
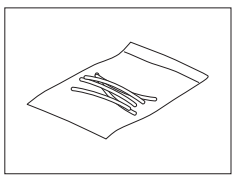
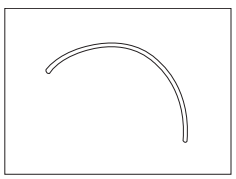
Silicone tube (pressure tube to solvent manager)
850 mm

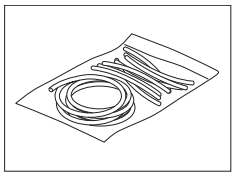
51105581



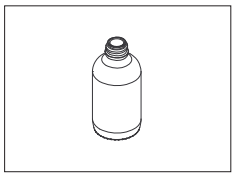
Draining tube / Dispensing tube

51107481

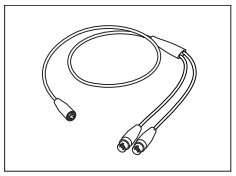
	Adapter for immediate draining	**51105594**
	Screw top (for bottles)	**23937**
	O-ring (4 pcs.) for screw tops	**51107496**
	Bottle adapter Merck, Germany Fisher, USA	 **23774** **23787**
	Clear glass bottle 1 l	**30079610**
	Pump SD660 Diaphragm with Suction Tube	**30094165**
	Pump SP280 Peristaltic with novoprene tubing and connectors	**30094237**
	Silicone tubes (5x118 mm)	**51108149**
	ChemSure tube for pumps (1x120 mm)	**30094297**



Novoprene tubes (1x1 m + 10x118 mm) **51190969**

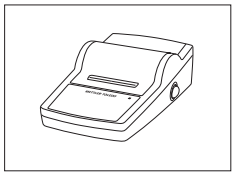


Brown glass bottle
1 l **71296**

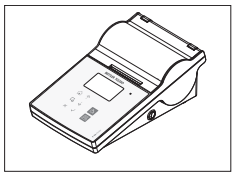


Y cable stirrer/pump, 5-pin **51109889**

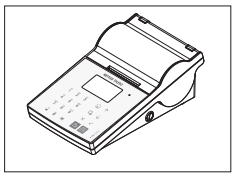
18.9 Printers



Lab equip access. data writer USB-P25/01 **11124301**

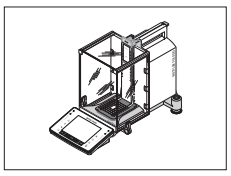


Lab equip access. data writer P-56RUE **30094673**

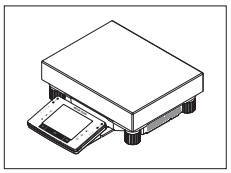


Lab equip access. data writer P-58RUE **30094674**

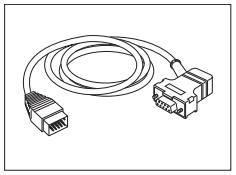
18.10 Balances



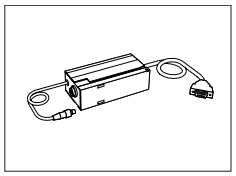
Analytical balances –
- XPE, XSE, XS
- MS, ML, ME-T, ME



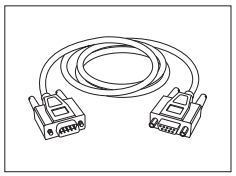
Precision balances –
- XPE, XS
- MS, ML, ME-T, ME



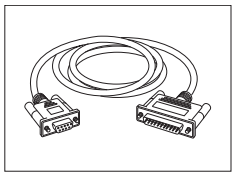
Connection cable for METTLER TOLEDO balance (MiniMettler) **229029**



Connection cable for METTLER TOLEDO balance (LC interface) **229065**

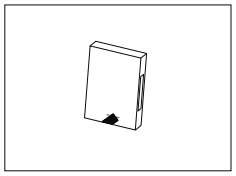


Connection cable for METTLER TOLEDO balance (RS9 interface) **11101051**

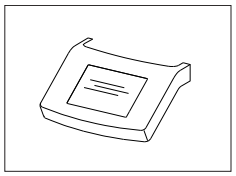


Connection cable for SARTORIUS balances (RS9-RS25) **51190363**

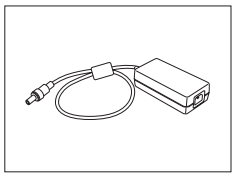
18.11 Miscellaneous accessories



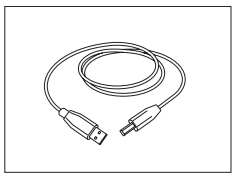
CD Titration User Documentation **30297239**



Protective cover for touchscreen **51105567**



External power supply (100 – 240 V) **51105795**



USB cable A-B (for PC or printer)
180 cm **51191926**

19 Appendix

19.1 Predefined calibration standards for pH sensors

METTLER TOLEDO EU (Ref. 25°C)	METTLER TOLEDO USA (Ref. 25°C)	DIN (19266) /NIST (Ref. 25°C)	DIN (19267) (Ref. 25°C)	MERCK (Ref. 20°C)
2.00	1.68	1.680	1.09	1.00
4.01	4.01	3.557	3.06	2.00
4.60	7.00	3.775	4.65	3.00
7.00	10.01	4.008	6.79	4.00
9.21		6.865	9.23	4.66
10.00		7.416	12.75	5.00
11.00		9.184		6.00
		10.014		6.88
		12.454		7.00
				8.00
				9.00
				9.22
				10.00
				11.00
				12.00
				13.00

Fluka (Ref. 20°C)	Novartis (Fluka) (Ref. 20°C)	FISHER (Ref. 25°C)	JIS Z 8802 (Ref. 25°C)	JJG119 (Ref. 25°C)
1.00	4.00	1.00	1.679	1.680
2.00	7.00	2.00	4.008	3.559
3.00	9.00	3.00	6.865	4.003
4.00		4.00	7.413	6.864
5.00		5.00	9.180	7.409
6.00		6.00	10.01	9.182
7.00		7.00		12.460
8.00		8.00		
9.00		8.991		
10.00		10.00		
11.00		11.00		
12.00				
13.00				

19.1.1 Temperature related values

19.1.1.1 METTLER TOLEDO

METTLER TOLEDO EU (Ref. 25°C)

Temp. [°C]	pH						
0	2.03	4.01	4.66	7.12	9.52	10.65	11.90
5	2.02	4.01	4.65	7.09	9.45	10.52	11.72
10	2.01	4.00	4.64	7.06	9.38	10.39	11.54
15	2.00	4.00	4.63	7.04	9.32	10.26	11.36
20	2.00	4.00	4.62	7.02	9.26	10.13	11.18
25	**2.00**	**4.01**	**4.60**	**7.00**	**9.21**	**10.00**	**11.00**
30	1.99	4.01	4.61	6.99	9.16	9.87	10.82
35	1.99	4.02	4.62	6.98	9.11	9.74	10.64
40	1.98	4.03	4.63	6.97	9.06	9.61	10.46
45	1.98	4.04	4.64	6.97	9.03	9.48	10.28
50	1.98	4.06	4.66	6.97	8.99	9.35	10.10
55	1.98	4.08	4.67	6.98	8.96	9.22	9.92
60	1.98	4.10	4.69	6.98	8.93	9.09	9.74
70	1.99	4.16	4.71	7.00	8.88	8.96	9.56

Temp. [°C]	pH						
80	2.00	4.22	4.73	7.04	8.83	8.83	9.38
90	2.00	4.30	4.75	7.09	8.79	8.70	9.20
95	2.00	4.35	4.77	7.12	8.77	8.57	9.02

METTLER TOLEDO USA (Ref. 25°C)

Temp. [°C]	pH			
5	1.67	4.01	7.09	10.25
10	1.67	4.00	7.06	10.18
15	1.67	4.00	7.04	10.12
20	1.68	4.00	7.02	10.06
25	**1.68**	**4.01**	**7.00**	**10.01**
30	1.68	4.01	6.99	9.97
35	1.69	4.02	6.98	9.93
40	1.69	4.03	6.97	9.89
45	1.70	4.04	6.97	9.86
50	1.71	4.06	6.97	9.83

19.1.1.2 DIN / NIST

DIN (19266) / NIST (Ref. 25°C)

Temp. [°C]	pH								
0	1.666	3.577	3.863	4.010	6.984	7.534	9.464	10.317	13.423
5	1.668	3.573	3.837	4.004	6.950	7.502	9.392	10.248	13.207
10	1.670	3.569	3.819	4.001	6.922	7.474	9.331	10.180	13.003
15	1.672	3.565	3.801	4.001	6.900	7.451	9.277	10.121	12.810
20	1.676	3.561	3.787	4.003	6.880	7.432	9.228	10.066	12.627
25	**1.680**	**3.557**	**3.775**	**4.008**	**6.865**	**7.416**	**9.184**	**10.014**	**12.454**
30	1.685	3.553	3.766	4.015	6.853	7.405	9.144	9.970	12.289
35	1.691	3.549	3.759	4.026	6.845	7.396	9.110	9.928	12.133
40	1.697	3.549	3.754	4.036	6.837	7.389	9.076	9.892	11.984
45	1.704	3.544	3.751	4.049	6.834	7.386	9.046	9.856	11.841
50	1.712	3.548	3.748	4.064	6.833	7.384	9.018	9.830	11.705
55	1.715	3.554	3.750	4.075	6.834	7.382	8.985	9.804	11.574
60	1.723	3.560	3.753	4.091	6.836	7.380	8.962	9.778	11.449
70	1.743	3.580	3.763	4.126	6.845	7.378	8.921	9.752	11.324
80	1.766	3.609	3.780	4.164	6.859	7.376	8.885	9.726	11.199
90	1.792	3.650	3.802	4.205	6.877	7.374	8.850	9.700	11.074
95	1.806	3.674	3.815	4.227	6.886	7.372	8.833	9.674	10.949

DIN (19267) (Ref. 25°C)

Temp. [°C]	pH					
0	1.08	3.12	4.67	6.89	9.48	13.89
5	1.08	3.11	4.67	6.87	9.43	13.63
10	1.09	3.10	4.66	6.84	9.37	13.37
15	1.09	3.09	4.66	6.82	9.32	13.16
20	1.09	3.07	4.65	6.80	9.27	12.96
25	**1.09**	**3.06**	**4.65**	**6.79**	**9.23**	**12.75**
30	1.10	3.05	4.65	6.78	9.18	12.61
35	1.10	3.05	4.65	6.77	9.13	12.45
40	1.10	3.04	4.66	6.76	9.09	12.29
45	1.10	3.04	4.67	6.76	9.04	12.09
50	1.11	3.04	4.68	6.76	9.00	11.98
60	1.11	3.04	4.70	6.76	8.92	11.69
70	1.11	3.04	4.72	6.76	8.88	11.43
80	1.12	3.05	4.75	6.78	8.85	11.19
90	1.13	3.07	4.79	6.80	8.82	10.99

19.1.1.3 MERCK

MERCK (Ref. 20°C)

Temp. [°C]	pH							
0	0.96	2.01	3.05	4.05	4.68	5.06	6.04	6.98
5	0.99	2.01	3.05	4.04	4.68	5.05	6.02	6.95
10	0.99	2.01	3.03	4.02	4.67	5.02	6.01	6.92
15	0.99	2.00	3.01	4.01	4.67	5.01	6.00	6.90
20	**1.00**	**2.00**	**3.00**	**4.00**	**4.66**	**5.00**	**6.00**	**6.88**
25	1.01	2.00	3.00	4.01	4.66	5.00	6.02	6.86
30	1.01	2.00	3.00	4.01	4.66	5.00	6.03	6.86
35	1.01	2.00	3.00	4.01	4.66	5.00	6.03	6.85
40	1.01	2.00	2.98	4.01	4.67	5.00	6.04	6.84
45	1.01	2.00	2.98	4.01	4.67	5.01	6.05	6.84
50	1.01	2.00	2.97	4.00	4.68	5.01	6.06	6.84
60	1.02	2.00	2.97	4.00	4.69	5.04	6.10	6.84
70	1.02	2.01	2.97	4.00	4.70	5.05	6.12	6.84
80	1.02	2.01	2.97	4.00	4.71	5.10	6.17	6.86
90	1.02	2.01	2.96	4.00	4.72	5.14	6.24	6.88

MERCK (Ref. 20°C) (continued)

Temp. [°C]	pH							
0	7.13	8.15	9.24	9.46	10.26	11.45	12.58	13.80
5	7.07	8.10	9.16	9.40	10.17	11.32	12.41	13.59
10	7.05	8.07	9.11	9.33	10.11	11.20	12.26	13.37
15	7.02	8.04	9.05	9.28	10.05	11.10	12.10	13.18
20	**7.00**	**8.00**	**9.00**	**9.22**	**10.00**	**11.00**	**12.00**	**13.00**
25	6.98	7.96	8.95	9.18	9.94	10.90	11.88	12.83
30	6.98	7.94	8.91	9.14	9.89	10.81	11.72	12.67
35	6.96	7.92	8.88	9.10	9.84	10.72	11.67	12.59
40	6.95	7.90	8.85	9.07	9.83	10.64	11.54	12.41
45	6.95	7.88	8.82	9.04	9.79	10.56	11.44	12.28
50	6.95	7.85	8.79	9.01	9.74	10.48	11.33	12.15
60	6.96	7.83	8.73	8.96	9.67	10.33	11.04	11.75
70	6.96	7.80	8.70	8.93	9.62	10.19	10.90	11.61
80	6.97	7.78	8.66	8.89	9.55	10.06	10.70	11.39
90	7.00	7.75	8.64	8.85	9.49	9.93	10.48	11.15

19.1.1.4 FLUKA

FLUKA (Ref. 20°C)

Temp. [°C]	pH					
0	0.94	1.99	3.03	4.03	5.05	6.03
10	0.99	1.99	3.02	4.02	5.02	6.01
20	**1.00**	**2.00**	**3.00**	**4.00**	**5.00**	**6.00**
30	1.00	2.00	3.00	4.00	5.00	6.02
40	1.01	2.00	2.99	4.00	5.00	6.04
50	1.01	2.00	2.98	4.00	5.02	6.06
60	1.01	2.00	2.98	4.00	5.04	6.09
70	1.01	2.00	2.98	4.00	5.07	6.13
80	1.02	2.00	2.98	4.00	5.10	6.18
90	1.02	2.00	2.97	4.00	5.13	6.24

FLUKA (Ref. 20°C) (continued)

Temp. [°C]	pH						
0	7.13	8.18	9.24	10.24	11.45	12.58	13.71
10	7.05	8.09	9.11	10.10	11.20	12.26	13.35
20	**7.00**	**8.00**	**9.00**	**10.00**	**11.00**	**12.00**	**13.00**
30	6.98	7.94	8.93	9.90	10.81	11.75	12.66

Temp. [°C]	pH						
40	6.97	7.90	8.86	9.82	10.64	11.53	12.37
50	6.96	7.86	8.80	9.75	10.48	11.31	12.10
60	6.96	7.82	8.75	9.68	10.33	11.09	11.84
70	6.97	7.80	8.71	9.62	10.19	10.88	11.61
80	6.98	7.77	8.67	9.55	10.06	10.68	11.40
90	7.00	7.75	8.64	9.49	9.93	10.48	11.20

NOVARTIS (FLUKA) (Ref. 20°C)

Temp. [°C]	pH		
0	4.01	7.11	9.20
5	4.00	7.08	9.15
10	4.00	7.05	9.10
15	4.00	7.02	9.05
20	**4.00**	**7.00**	**9.00**
25	4.01	6.98	8.96
30	4.01	6.97	8.91
35	4.02	6.96	8.88
40	4.03	6.95	8.84
45	4.04	6.94	8.80
50	4.06	6.94	8.77
55	4.07	6.93	8.74
60	4.09	6.93	8.71
65	4.11	6.93	8.69
70	4.13	6.94	8.67
75	4.14	6.94	8.65
80	4.16	6.95	8.63
85	4.18	6.96	8.61
90	4.21	6.97	8.60
95	4.23	6.98	8.59

19.1.1.5 FISHER

FISHER (Ref. 25°C)

Temp. [°C]	pH										
0				4.01	5.05	6.07	7.13	8.15	9.166	10.34	11.80
5	0.95	1.98	2.98	3.99	5.04	6.05	7.10	8.13	9.126	10.26	11.69
10	0.98	1.98	2.97	4.00	5.03	6.06	7.07	8.08	9.089	10.19	11.46
15	1.01	2.02	3.00	3.99	4.99	6.05	7.05	8.01	9.055	10.12	11.31
20	1.01	2.00	3.00	4.00	5.00	6.00	7.02	8.00	9.022	10.06	11.17
25	**1.00**	**2.00**	**3.00**	**4.00**	**5.00**	**6.00**	**7.00**	**8.00**	**8.991**	**10.00**	**11.00**
30	1.02	2.00	3.02	4.01	5.01	5.99	6.99	8.00	8.961	9.94	10.88
35	1.03	2.02	3.03	4.02	5.01	5.98	6.98	7.95	8.930	9.90	10.76
40	1.02	2.01	3.03	4.03	5.04	5.97	6.97	7.94	8.902	9.85	10.62
45	1.03	2.01	3.04	4.04	5.06	5.97	6.97	7.94	8.874	9.81	10.52
50	1.03	2.01	3.04	4.06	5.08	5.96	6.97	7.93	8.845	9.78	10.41
55				4.07			6.97		8.815	9.74	
60				4.09			6.98		8.784	9.70	
65				4.11			6.99			9.68	
70				4.13			7.00			9.65	
75				4.14			7.02			9.63	
80				4.16			7.03			9.62	
85				4.18			7.06			9.61	
90				4.21			7.08			9.60	
95				4.23			7.11			9.60	

19.1.1.6 JIS / JJG

JIS Z 8802 (Ref. 25°C)

Temp. [°C]	pH					
0	1.666	4.003	6.984	7.534	9.464	10.32
5	1.668	3.999	6.951	7.500	9.395	10.24
10	1.670	3.998	6.923	7.472	9.332	10.18
15	1.672	3.999	6.900	7.448	9.276	10.12
20	1.675	4.002	6.881	7.429	9.225	10.06
25	**1.679**	**4.008**	**6.865**	**7.413**	**9.180**	**10.01**
30	1.683	4.015	6.853	7.400	9.139	9.97
35	1.688	4.024	6.844	7.389	9.102	9.92
40	1.694	4.035	6.838	7.380	9.068	9.89
45	1.700	4.047	6.834	7.373	9.038	9.86
50	1.707	4.060	6.833	7.367	9.011	9.83
55	1.715	4.075	6.834	7.361	8.985	9.80
60	1.723	4.091	6.836	7.355	8.962	9.77
70	1.743	4.126	6.845	7.349	8.921	9.74
80	1.766	4.164	6.859	7.343	8.885	9.71
90	1.792	4.205	6.877	7.337	8.850	9.68
95	1.806	4.227	6.886	7.331	8.833	9.65

JJG119 (Ref. 25°C)

Temp. [°C]	pH						
0	1.668	3.599	4.006	6.981	7.515	9.458	13.416
5	1.669	3.591	3.999	6.949	7.490	9.391	13.210
10	1.671	3.583	3.996	6.921	7.467	9.330	13.011
15	1.673	3.575	3.996	6.898	7.445	9.276	12.820
20	1.676	3.567	3.998	6.879	7.426	9.226	12.637
25	**1.680**	**3.559**	**4.003**	**6.864**	**7.409**	**9.182**	**12.460**
30	1.684	3.551	4.010	6.852	7.395	9.142	12.292
35	1.688	3.547	4.019	6.844	7.386	9.105	12.130
40	1.694	3.547	4.029	6.838	7.380	9.072	11.975
45	1.700	3.550	4.042	6.834	7.379	9.042	11.828
50	1.706	3.555	4.055	6.833	7.383	9.015	11.697
55	1.713	3.563	4.070	6.834	7.387	8.990	11.553
60	1.721	3.573	4.087	6.837	7.391	8.968	11.426
70	1.739	3.596	4.122	6.847	7.399	8.926	11.172
80	1.759	3.622	4.161	6.862	7.407	8.890	10.918
90	1.782	3.648	4.203	6.881	7.415	8.856	10.664
95	1.795	3.660	4.224	6.891	7.419	8.839	10.537

19.2 System validation

The products / systems were tested in respect of functionality and specification prior to shipment. In order to support GLP and validation requirements, we will make the following documents available to authorized persons for inspection:

- Performance specifications
- Market and technical requirements
- Quality plan
- Project management system
- Plan and Test results
- Review reports

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